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ABSTRACT

This collection of papers presented at a conference organized by the Commission on Undergraduate Education in the Biological Sciences includes an account of the evolution of biology teaching and a discussion of its potential for bridging the gap between the "two cultures". Strategies for innovation are suggested, the results of a survey of teacher training given to biology teaching assistants are reported and six categories of activities that college teachers perform are postulated. Alternatives to the Ph.D. degree are discussed. Possible funding sources for projects designed to improve the quality of undergraduate biology teaching are outlined by representatives of the National Science Foundation, the Danforth Foundation, and the U.S. Office of Education. Reports of conference working groups on "Making the Teaching Experience a Learning Experience", "A Model Intern Program", and "Guidelines for a Degree for College Biology Teachers" conclude the report. (AL)

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COMMISSION ON UNDERGRADUATE EDUCATION IN THE BIOLOGICAL SCIENCES

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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MEMO NO. 70-12

NEW ENGLAND CONFERENCE ON PRESERVICE PREPARATION OF COLLEGE BIOLOGY TEACHERS

May 7-8, 1970

The third regional conference on the preservice preparation of college biology teachers took place under dramatic circumstances. Four students had just been killed at Kent State University and fuses were burning short on campuses throughout the country. Some administrators and faculty members who had long planned to attend the conference found it imprudent to leave their responsibilities on campus, not knowing what they would find when they returned. Many who did attend commuted in hasty sallies or kept in touch by telephone with the volatile events at home. All of this lent a note of urgency to the proceedings. Business as usual seemed out of place.

The same note of urgency and will to find a way is reflected in this report of the conference. Laura Bornholdt's straight-from-the-shoulder talk merits throughtful attention. In the words she used at the conference, "Rebellion is becoming increasingly entrenched and people are separated rather than linked, in some cases, by the teaching-assistant experience.... I think that if we do not convince the young that it is possible to change within the system and do exciting things with the curriculum, the university world of 1990 is going to be a very different and, to me, not a very attractive place."

The participants responded to Edward Hodgson's heartfelt call for action with an earnest search for solutions. Frank Koen was at his best as he laid out a program for instructing T.A.'s. Donald Dean reported the findings of a CUEBS survey of department chairmen.

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Be sure to read the clash of ideas about the Doctor of Arts degree as it was discussed by a panel headed by E. J. Boell. Edward Moore stoutly advocated the Doctor of Arts program and Trevor Colbourn reluctantly concluded that despite the merits of the degree it will be considered second-rate. Alex Henderson, an employer of college teachers, and Barrett Rock, a future college teacher, took a middle course. Alfred Borg took the position that new degrees will be adopted no matter what; we must stop fighting them and see that they meet a high standard.

The big break-through of the conference was the news that the foundations are concerned enough about the kind of experience teaching assistants receive to use the power of the purse to influence reform. For example, Lawrence Friedrich of USOE reported that from now on institutions which hope to receive fellowships to aid in the preparation of future college teachers will be expected to show evidence of a serious program to that end.

The three working groups gave serious thought to two vehicles for better preparation of teachers: the teaching assistant experience and alternatives to the traditional Ph.D. Their reports are well worth reading.

Dr. Langley Wood and Dean Colbourn of the University of New Hampshire were particularly generous to contribute to the conference in such a significant way at a time when they were deeply involved in resolving a campus confrontation. The gracious accommodations of the New England Center for Continuing Education added much to the conference.

If intelligent and earnest endeavors of the participants at the conferences this year (Washington, Ann Arbor, Berkeley, and New Hampshire) were characteristic of all members of the graduate community, the preparation of college biology teachers would not be a problem.

Let us hope that those who attended a conference and the larger group who attended vicariously by way of the reports found new ideas and were strengthened in their convictions by the discovery that others care. We hope that they will act as a rallying point for concerned people who intend to do something about this critical issue.

Donald S. Dean
Staff Biologist

CONFERENCE ON PRESERVICE PREPARATION OF COLLEGE BIOLOGY TEACHERS

New England Center
Durham, New Hampshire

May 7 and 8, 1970

Thursday, May 7, 1970

8:30 Registration

9:00 Welcome and Orientation to the Conference

Dr. Edward J. Kormondy, Director of CUEBS

A Challenge: Preparation for What?

Dr. Edward S. Hodgson, Tufts University

9:30 In Search of a Way: A report of the innovative ideas on preparation of college teachers reported by departments offering Ph.D.-level programs in biology

Dr. Donald S. Dean, Staff Biologist, CUEBS

10:00 Coffee

10:30 On Becoming a College Teacher

Dr. Frank M. Koen, Center of Research in Learning and Teaching, University of Michigan

12:15 Luncheon

1:30 <u>Alternatives to the Ph.D.</u>: A panel discussion.

Dr. E. J. Boell	Director Graduate Studies, Yale University
Dr. Edward C. Moore	Chancellor Board of Education, Commonwealth of Massachusetts
Dr. Trevor Colbourn	Dean Graduate School, University of New Hampshire.
Dr. Alex Henderson	Chairman, Biology Department, Millersville State College, Pa.
Mr. Barrett Rock	Department of Botany, University of Maryland

3:00 Working Groups

A. Making the Teaching Experience a Learning Experience

B. A Model Intern Program

C. Guidelines for a Degree for College Biology Teachers

6:30 Dinner

Evening: Unscheduled except for visits to the new Jackson Estuarine Lab on Great Bay Estuary arranged by Dr. Langley Wood, University of New Hampshire.

Friday, May 8, 1970

9:00 Foundation Support for the Preparation of Better Teachers in Higher Education

Dr. Alfred F. Borg	Division Undergraduate Education National Science Foundation, Chm.
Dr. Fred S. Honkala	Div. Graduate Education National Science Foundation
Dr. Laura Bornholdt	Danforth Foundation
Dr. Lawrence Friedrich	Division University Programs U.S. Office of Education

10:30 Coffee

11:00 Report of the Working Sessions

12:15 End of Conference.

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May 7-8, 1970

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A Challenge: Preparation for What?

Edward S. Hodgson
Tufts University

The encouraging recent concern with the preparation of college biology teachers presupposes that we understand what they are to be trained for. As far as the subject matter they should master within the discipline of biology, there are relatively few areas of disagreement. However, with regard to the changing student populations we teach, the techniques of communicating with them, and the college or university structures which provide a context for our teaching, I strongly suspect that much of our thinking is dated, unrealistic, and already inadequate to the job we might be doing. Certainly it falls short of providing very satisfactory models for what our college teacher trainees are eventually going to be doing if they aspire to making first-rate contributions in the future.

The intent here is not to review or castigate present shortcomings of the graduate training system, for these defects have already come under scrutiny from a variety of viewpoints. Nor is it realistic to anticipate that any "expert" will provide a handful of pat solutions to what is obviously a very complex set of problems, few of them unique to biology. It may be useful, however, to examine the novel aspects of our profession which are beginning to confront college and university biology teachers, and which will certainly determine much of their effectiveness in the future. Obviously, the quality of imagination and vigor with which today's graduate students respond to these challenges, and to others still unforseen, will determine whether they become the hoped-for "new breed" of biologists or whether, as in that oft-cited and dreary analogy, they will merely "polish up the handle of the stagecoach".

The Evolution of Biology Teaching

Perspective on the future can be sharpened by reminding ourselves what we have already passed through. It does not require any very ancient roots in our profession to have experienced three phases (epochs?) in the evolution of biology as a scientific discipline. Since teachers generally try to communicate in ways optimally compatible with their subject material,

it is hardly surprising that each of these phases has produced a characteristic style and content of curricula and teaching methods.

Phase 1: Research and teaching were originally outgrowths of a hobbyist's approach. There was much emphasis upon descriptive natural history and an early form of ecology ("under the rock--over the rock"). Curricula emphasized the biology of particular taxonomic groups. Physiology courses concentrated upon organ systems and tissues.

Phase 2: Rapid progress in genetic and biochemical research emphasized the essential unity of many life processes at cellular and molecular levels. In teaching, the "core" courses reflected this viewpoint, with the extremes of such resembling the labels of oceanographic soundings--"Cores 1,2,3, or A,B,C," being required before students could advance to other matters. Cores, or bodies of information required by some other means, usually emphasized cell physiology and the macromolecular mechanisms in cell division and differentiation.

Phase 3: Then began a stage which we hardly know what to call because we are still experiencing its infancy. Within the strict discipline of biology, there is a more far-reaching synthesis of concepts aiming toward, as Paul Weiss summarized it, "...restoring information content that has been lost on the way down in the progressive analysis of the unitary universe into abstracted elements" (Weiss 1969). Symposia on the nature of biology "beyond reductionism" (e.g. Koestler and Smythies, 1969) explore new perspectives integrating areas of research which had developed largely as distinct specialities. An impressive example is provided by the biochemists, geneticists, physiologists, psychologists and others, who have converged on the outstanding frontiers of neurobiology, attempting to integrate their special viewpoints to understand the mechanisms of learning and memory, brain function, and related problems.

Social pressures have also played an important part in shaping the contemporary phase of biology. Blame for depredations of the environment, pollution, the population crisis, urban blight, drug abuse, etc., can hardly be concentrated upon professional biologists. However, now that these situations have become severe enough to be recognized by the responsible public as intolerable, the failure of a sensible and humane biological viewpoint to effectively permeate our culture is tragically evident for all to ponder. And to this failure the modern teaching of biology must be sensitive and responsive also.

In summary, the third phase of biology teaching is characterized by a greater emphasis upon multi-disciplinary synthesis and a concern with the social applications of biological discoveries . This stage parallels a general cultural evolution in which we increasingly evaluate the quality of life, rather than focusing almost exclusively upon its quantitative features. Similar trends can be found in most areas of advanced study and training. A study of 120 different graduate departments in 10 top-ranking graduate institutions, carried out by the Center for Research and Development in Higher Education at Berkeley, revealed a common trend toward a "return to relevance and to a concern for the interconnectiveness of knowledge" (Heiss, 1968).

An unfortunate error, all too frequently encountered during any discussion of the evolution of research or teaching approaches, is the assumption that each new phase completely abolishes any substantial values of the earlier phases. For example, a molecular biologist, to whom the most elementary facts of natural history are terra incognita, may pride himself upon this very fact, and indoctrinate his graduate trainees with the same tunnel vision and historical amnesia. Ironically, such an individual is among those who suffer most during the transition to the next phase when, to mention one example, an expert in mathematical analysis of populations (himself unable to tell one end of a molecule from another) infects his proteges with the notion that the whole reductionist trend in biology, culminating in the "central dogma" of DNA, is a kind of simplistic children's game leading away from the sophisticated study of population ecology which is the "only thing" deserving top priority today--("so what if you can make a gene, when the population crisis and a poisonous environment will destroy us if we don't immediately put our energies on those problems?").

These distortions produce concomitant weaknesses in teaching. One body of subject matter, and the teaching approaches which developed in relation to it, are apt to take on a semi-sacred aura, zealously protected by the proponents who, inevitably, are soon surrounded by change. In reality, each phase adds to the range of subject matter and teaching methods available to us. The important challenge is how to select, from among all the possibilities, the most vigorous and pertinent subject areas for analysis with students, and to facilitate student involvement by the most effective means. In the immediate future, at least, the challenge appears to be in trying to connect the whole range of basic biological knowledge to a wide assortment of environmental and social problems.

The Stakes are High

Aspirant college teachers of biology and those who train them cannot fail to take their commitments seriously if they give the slightest thought to the social impact of their work. The stakes in this effort today are almost incalculably high. Probably no person has articulated this more impressively than C.P. Snow, starting in his Rede Lecture of 1959, and eventually in his "second look" essay (Snow, 1964). Lord Snow drew attention to the fact that the intellectual life of the whole of western society was increasingly polarized into two groups, scientists and non-scientists. Within the innocence separating these two polar groups, he found the roots for our failure to deal adequately with the chief menaces at this period of history--nuclear war, overpopulation, and the gap between the rich and poor.

Who is going to bridge the gulf between the "two cultures"? Scientists, sharing an assortment of general interests and concerns with the rest of humanity, seem to find it easier to move out of their specialized territories than for the non-scientists to invade the laboratories. Biologists enjoy a special advantage in this respect. Even staunch opponents of science (or of some caricature of science which they prefer) usually remain deeply interested in at least some living organisms--themselves. Also, the significance of any scientific discovery becomes especially convincing to most people when it touches the biological level and affects man, his agriculture, well being, etc.

The special advantage of biology for bridging the two culture gap is commonly reflected in the choices made by students in "satisfying" college requirements for some science as a part of a liberal arts or general education requirement. At each of three major universities in New York City, and two in Boston, which I had occasion to query in 1968, the number of biology majors was equal to or larger than the combined numbers of students majoring in all other sciences, excluding mathematics. Furthermore, in each of these institutions, the number of non-majors who took at least a year of biology was equal to, and in 3 of the 5 institutions, was greater than the number of majors in biology. Admittedly, this is a small sample, and it would be interesting to know how representative it really is of the national picture. It would also require much further study to assess all the motives behind such biases in the choices of college students. Some, doubtless, believe that they can find in biology a haven from the needs for mathematical rigor, or they anticipate a better steppingstone into some post-graduate training, such as medical school. For a majority of students at these five

universities in the Northeast, and for whatever reasons, biology was clearly the main contact with any kind of science and not uncommonly it was the only contact.

These are the students taught by the 73% of newly trained college biology teachers who, regardless of whatever they expected to be doing, actually teach some sort of first-level course in biology after getting their advanced degrees (Humphrey and Wise, 1968). In terms of our total national culture, we are therefore concerned with the training of professionals who will give a large proportion of our college-educated citizenry their best glimpse, and sometimes their only one, of the major source of power, intellectual output, and a substantial proportion of the esthetics of our society. If this seems a shallow jingoistic viewpoint, it might be remembered that Lord Snow, with no vested interest in biology, came to the conclusion, during his "second look" at the two cultures problem, that biology was ideally suited for this role. Molecular biology, and neurobiology in the future, were anticipated to affect human viewpoints more profoundly than any scientific advance since Darwin, leading toward the emergence of a "third" culture in which the ills of irrational polarization would be healed. Surely the importance of this job deserves the very best teachers, resources, and educational technology that society can achieve!

There is, in the very urgency and importance of this job, a concomitant pitfall. If the college teacher is to preserve the long-range perspective, and further the contributions in basic understanding which are part of his particular responsibility in society, he cannot simply "drop everything" and become caught up in whatever immediate applied problem is the focus of most national concern at any moment. George Maslach (1970) put it succinctly: "A pedestrian treatment of new national concerns could obviously be obtained within a university, but only at the cost of eroding the undergraduate teaching effort." He goes on to warn that the greatest conflict may not be the publicized one between teaching and research, but "...the more alarming contest of teaching and research versus public service".

Failure to resolve this particular contest into some workable balance is more likely if the graduate student has not been helped to foresee it, or the new teacher is unsure of the long-range value of his own teaching and research. Students suffer as well, because instructors who cannot resolve this problem themselves are hardly in a position to explain, convincingly, the basic contributions which biology can make to contemporary social problems. And this may be, as noted above, the greatest single challenge facing professional biologists in today's teaching.

Relevance Without Overstretch

If we are going to integrate our expanding "mission-oriented" role of biology (relevance to contemporary social problems) with the "discipline-oriented" role (progress on underlying basic research and synthesis), we will need to expend energies in more carefully thought out ways than has been true in the past. Otherwise, a kind of intellectual overstretch may set in, with the usual unfortunate results of that condition. The central challenge is how to meet the modern teaching needs while maintaining the essential core of on-going discipline-oriented work. The experiments and interpretations offered here are not viewed as constituting the solution to this challenge, but as indicators of needs and suggestions of some possible ways of helping.

1. Supplying the missing links in communicating "relevance". It is clear that there is a need for developing more skills in relating recognizable social problems to their biological underpinning. Donald Dean recently pointed out that "the person...who found a way to prolong the life of a railroad tie probably saved more forests than anyone doing the more exciting and satisfying job of saving a redwood forest". Probably very few students would recognize this connection however, unless it was skillfully pointed out. As Dr. Dean concludes, "There will be no substitute for knowledge in the solution of our problems of survival."

The missing link that foils so many attempts to disclose relevant interrelationships is often simply ignorance--on the part of the teacher as well as the student. This was revealed in a case which I recently encountered. A student explained that she would not be attending a seminar by a distinguished visitor in our department who was going to discuss neurological mechanisms in violent behavior in man: she felt that a political rally, scheduled for the same time, would be more "relevant". Tragically, that particular rally degenerated into chaotic and uninhibited violence, attaining a ferocity unusual even in these times. The student was deeply shocked but, even in retrospect, saw no connection between the violence she had encountered and the subject of the seminar she had missed. She was simply not prepared for this kind of analysis of human behavior.

Possibly even more significant, the teaching assistants who participated in the seminar, were very anxious to incorporate some of this material into their own discussion sections, but felt powerless to do so for lack of any previous acquaintance with this field. Fortunately, our guest provided them with a short bibliography of the pertinent articles, and an excellent round of

follow-up discussion periods grew out of this new material. Would it not be helpful if teachers at all levels of experience had much easier access to crucial literature outside their own particular areas of biology? A few more easily accessible guidebooks or bibliographies, selective enough to be practically useful, could make a very significant contribution here.

2. Improving the quality of student involvement. If the so-called "life style" of a student is exactly the same at the end of a general biology course as at the beginning, his teacher has probably failed even if the student has not! A keener ability to appraise evidence, to grasp implications in the science columns of a first-rate newspaper, or perhaps the strengthening of a life-long taste in reading or museum-going to perpetuate the pleasures of learning--all are gratifying results. They are less likely to occur, however, if students can drift into the expectation that learning will occur three times a week, at a particular hour, in a particular classroom or laboratory.

Students do, indeed, become the victims of sets, such that they expect to learn (and do learn) only under rather limited circumstances. What then happens when they graduate? Intellectual stagnation sets in all too often. Obviously, the contribution which a new instructor can make, if he has imagination and intellectual force enough to escape his own past programming, is to free students from some of the more obviously limiting sets. Several of the following experiments were designed to take this need into account, and achieve longer-lasting, or even self-perpetuating learning. In my experience, such innovations generally work best in the hands of younger instructors, and the quality of involvement with the educational process which they can produce far exceeds the emergency responses to alienation which now make headlines. Perhaps the best way of cultivating these possibilities is to make sure that every graduate teaching assistant has a chance to organize one laboratory or other section of a course completely on his own as a planned part of his training. Everyone may benefit.

3. Exploiting the modern gadgetry. There is a widespread suspicion of what electronic devices may do toward rendering college teachers obsolete. This is understandable in view of the video cassettes which are already able to store 500 books of 50,000 words each, or a complete opera, in a single small reel and to reproduce any of these, as desired, through a home television receiver (Field, 1970). The chief educational significance of even these marvels, however, can be to free the instructor of tomorrow from much routine, so that he can do a

better job. Moreover, we do not have to wait for video cassettes or make a large investment to profit immediately from the cassette era and still avoid the main drawbacks of mechanized instruction. This can be illustrated by an actual case.

This experiment resulted from a lack of good demonstration materials. In a first-level biology course, I wanted to discuss speciation, using Darwin's Galapagos finches to introduce crucial questions about evolution. As anyone who has ever seen them knows, these little birds are about as dismal in appearance as their impact on western thought was brilliant. How could the excitement and the implications of Darwin's evidence of evolution be communicated via these creatures? Fortunately, the American Museum of Natural History, a short subway ride distant from the University, had a fine collection of the birds, with excellent interpretive displays. As soon as the students were given a mimeographed instruction sheet to take to that exhibit, however, they concentrated upon "filling in the blanks" in order to hand in the assignment, rather than studying the exhibit for themselves or thinking about it in any very sophisticated way.

In some desperation, I decided to prepare a short tape-recorded annotation, including questions, related to that exhibit. This was loaned out to the students, with a small cassette playback unit which they could take to the museum whenever they wanted. This was a very amateur, very small scale experiment. There were 57 students in the course that year at Columbia and 81 people borrowed the tapes during the semester. All the instructors found that the students profited from the experience, for they remembered enough to answer questions very well at later discussion sections on the topic.

Additional possibilities for this way of breaking sets and enlarging the range of teaching materials were revealed when the same experiment was continued in Boston. It happens that the Galapagos finches displayed in Boston are not in a form likely to encourage bridges between the "two cultures", and so the study of that particular museum exhibit was dropped as a required part of the course being taken by 115 students at Tufts. To everyone's surprise, 27 of the students asked to borrow the old tape cassettes and carried them to New York during weekends and holidays, reporting favorably upon their impressions of the Galapagos exhibit. Two students noted that this purely elective option had given them their <u>first</u> introduction to the American Museum, even though their homes were in New York City!

What clearly emerges from this experience is that today's college students are impressively mobile, and strongly motivated (even without formal academic credit) when they can do things on their own good time and in novel ways. The results would probably not be unique to these particular cities, and suggests that many college and university students could profit from similar gentle guidance,within a 200 mile radius of their home universities. This is also one sort of learning which is quite likely to reinforce tastes which make learning a self-perpetuating process.

A key factor in the success of the experiment appears to have been the opportunity for extensive feedback from the students who used the cassette-recorded material. Course instructors could depend upon students having a solid background of observations and factual instruction before coming to discussion sessions. Teaching time can thus be spent on handling questions and discussion rather than formal lecturing on the material. Students enjoy working "on their own", yet appreciate the arrangement for speaking out and asking questions afterward. Similar success in avoiding the detraction of impersonality while using audio-tutorial techniques on a very large scale was reported by Kieffer (1970) in describing an interesting course offered in Illinois.

Obviously, there are a great many more kinds of electronic devices which are utilized in various teaching innovations. The advantage of this one is its simplicity and relatively low cost. The cassette, which can be carried anywhere, and allows the instructor to provide some guidance at the student's choice of pace, brings a very flexible tool to many different teaching situations. It may also provide a convenient means of connecting classroom and laboratory studies with the larger world "outside", while conserving the energies of instructors who find the effort congenial.

4. Innovation in the organization of academic institutions. Gone are the days when most professional biologists can pursue their research and keep abreast of their fields without assorted colleagues and instrumentation in contiguous areas. Understandably, the fear of isolation is one of the main worries of those who have just completed graduate work and are heading toward their first teaching jobs. Even if resources within their college are thin, consortia with neighboring institutions can provide the necessary overall strength.

Although rather loosely-knit consortia, with cross-listings of courses, are now well known, there is another level of innovation underway and certain to grow. This is the tailoring of certain staff appointments and courses specifically to fill the

needs of the total consortium, rather than any individual member institution alone. Obviously, the young professional who thrives on that kind of circulation and diffuse student body will find himself in a very different milieu than in most institutions today.

The main Boston consortium, which is now operating on a two-year experimental basis, provides links between the graduate schools of Boston, Brandeis, and Tufts Universities. Graduate trainees can select the most appropriate courses from the offerings of the three institutions, with an absolute minimum of red tape. It is probably indicative of the state of modern biology that the most far-reaching innovation within that consortium to date is in the life sciences. In response to a commonly felt need, staff members from each institution, plus the American Museum in New York, have joined together to teach a course which will acquaint students with research materials unique to the tropical marine environment, and which are especially suited for analysis of fundamental biological problems. When four different educational institutions in two different cities can organize a tightly integrated course to be offered at an overseas laboratory, with a faculty representing the fields of biochemistry, ecology, physiology, and animal behavior, there seems little excuse for hesitation regarding cooperative liaisons of the usual scope!

Strategy for Innovation

Most of the innovations with which we experiment today are at the level of tactical advances. What can be said in regard to a long-range strategy for improving biology teaching and a furthering of "biological awareness" throughout our culture in the coming decades?

Even without a planned strategy, a number of transformations appear certain to confront biologists who are newly attracted to college teaching positions. Their students will press harder to arrive at assessments of the social values of everything that is taught. The student leaders will be increasingly vocal, impatient, and mobile. Research and teaching cooperation with medical schools, other departments, and other colleges or universities will become almost universal for faculty; students will cultivate similar latitude in their sources of instruction, whenever possible. Assorted electronic "teaching aids" will be available, whether or not the teacher finds them of aid, or even has any notion what might be done with them. Much of the teaching will be categorized under rubrics unlike any used when the teacher himself was a student.

Beyond these changes which are already well underway, it would be foolish to attempt any detailed predictions. Extrapolation and examples from other fields do provide a few suggestions. For example, the advantages of interdisciplinary cooperation and consortia have become so apparent that a conscious strategy may well aim at expanding educational links beyond academic institutions per se. The most likely candidates for the next wave of cooperative links may be the nation's first-class museums (other than existing university museums), for these, as Dillon Ripley has argued persuasively, are already universities in themselves (Ripley, 1969). The better museums now carry on some of the most imaginative educational efforts to be seen anywhere. By virtue of their vast data banks and special facilities in the modern communication chain, they can be effective in some ways beyond the capacities of the best colleges and universities. Moreover, they are now in the process of reappraising and restructuring many of their own efforts, in order to attack contemporary problems (e.g. Galler, et al, 1968). It is doubtful that the present sporadic involvements of these museums with programs at the college and university level even begin to develop the potential yield which might result from cultivation of such collaborations. Who is going to tackle this challenge?

Another important element of future strategy will concern the uses made of television, especially when the potentials of the video cassette and live international television begin to be realized. A hint of the possibilities may be found in the enormous impact of the 13 lecture-demonstrations on "civilization" by Kenneth Clark. Originally prepared for television, these are now being shown around the world, often in connection with displays of local museum objects related to the topics under discussion. The parallels to lecture and laboratory are obvious, and there is even a text (Clark, 1969). Despite the fact that there is little cognizance of biology in Lord Clark's personal view of western civilization, there is no doubt that his is teaching innovation on a grand scale! If we biologists could do as well with that medium in communicating our own viewpoints, the effect might eclipse most of our teaching innovations thus far. Are any of our "new breed" of biologists prepared to address themselves to teaching challenges on this scale?

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In Search of a Way

Donald S. Dean
CUEBS

A graduate student wrote to us and said, "I have been following with interest what you have been doing with the preparation of college biology teachers. Where in this country is there a university that is really doing something interesting along this line? I am serious about college teaching as a life work and I want to know where the action is."

We have also received inquiries from faculty members who said, "Feed us your ideas. What ideas can you pass on to us from other people? We have come to the conclusion that we really ought to be doing more than we are doing."

With this as a stimulus, we began our fishing expedition--a search for models. We developed a questionnaire, keeping it as simple as possible because we had some feeling of guilt in adding more paperwork to the load of the department head.

In our first mailing we sent the inquiry to a college of biology, a division, or departments of biology if biology was organized on a unified basis. We sent to departments of botany and zoology in universities with that type of organization. We asked those who received the questionnaires to tell us where other inquiry would yield useful replies. Thus instead of sending them to every department of anatomy, physiology, or genetics, we sent them where someone indicated that they would be helpful in our search for ideas. Our purpose, then, was not to get a complete survey of what goes on but to find the best.

About two-thirds of the 489 forms sent out have been returned to date. Although we sent to departments offering the Ph.D. and those offering master's degrees, this report is based upon the 151 replies received from departments offering a degree at the Ph.D. level.

This report is by no means to be quoted as a picture of the current art. Those who are doing something were more likely to be asked and are strongly overrepresented. Many who had little to report still have the questionnaires on their desks.

Replies in percentages would be likely to give the false impression that all universities are engaged in a significant effort to improve college teaching. We have chosen, instead, to note which practices are widely used, which are common, and which are uncommon. The replies are ranked in order under these three headings.

STATEMENTS RANKED IN ORDER OF AFFIRMATIVE REPLIES	COMMENTS
ALMOST UNIVERSALLY PRACTICED	
1. Most of our graduate students gain experience teaching by acting as teaching assistants.	The fact that the T.A. experience is the major tool for the preparation of college teachers is the reason we have devoted so much time to the T.A. at these conferences.
2. All T.A.'s receive some kind of stipend.	One man replied, "Absolutely not! Why should they be paid any more than a person taking practice teaching is paid?" His view was decidely unpopular.
3. T.A.'s have an opportunity to teach at various levels (not only the beginning course).	There are places where a broad range of experiences is carefully built into the program for T.A.'s. In most cases, I fear, this reply should be interpreted to mean that teaching at more than one level is a possibility but probably not likely.
4. Our teaching assistants are closely supervised by a faculty member or senior teaching assistant charged with the course.	Many teaching assistants tell a different story

COMMONLY PRACTICED

5. Our teaching assistants have opportunity to engage in a variety of kinds of teaching experiences (lecture, laboratory, discussion).	While the opportunity is theoretically available in virtually all departments, very few reported that provision for a variety of experience was deliberately built into the program.
6. T.A.'s have opportunity for continuous consultation about their teaching throughout the semester.	Eighty-two percent claim this to be true in their departments. If this is so, it means that about one-fifth do <u>not</u> have opportunity for continuing consultation throughout the semester. It hardly seems possible that such a situation could exist in a reputable institution, yet when you talk to graduate students you get the distinct impression that it is possible for a T.A. to have no place to turn for criticism and help in his teaching. This is possibly the bitterest complaint of teaching assistants.
7. All graduate students are required to serve as T.A.'s.	This can be viewed in two ways. Since most Ph.D.'s in biology will teach, there is merit in requiring all to learn by being T.A.'s. One must also ask whether those who have difficulty speaking the language should be inflicted on beginning undergraduates. Since the future college teacher is presently the college teacher of a very large number of undergraduates the quality of the university in good part depends upon his performance.
8. We take steps to see that the prestige of a teaching assistant is the same as that of a research assistant.	Some went so far as to say that they find no need to take such steps because T.A.'s already have as much (or more) prestige. Some, as at Stony Brook reported that they pay T.A.'s more than research assistants. This, of course, was rare.

9. There is a ceiling on the contact hour load.	A typical contact load is 8-10 hours.
10. We have ranked our teaching assistants so that responsibility and perquisites increase with experience.	Many report that they do this informally.
11. We have a definite program of orientation for our teaching assistants.	We found no relationship at all between the size of the institution and the answer to this question. It would seem that the larger the institution the more the need for a formal program.

UNCOMMON PRACTICES

12. We supplement the teaching experience with a seminar or symposium on teaching.	See reference to this later in this report.
13. Our graduate students are encouraged to take a modest amount of course work in teaching.	Some filled the page with exclamation marks and declared, "Never. Over my dead body!"
14. We are engaged in an experimental program for preparation of college biology teachers.	Details are found in the appropriate part of this report.
15. We supplement the teaching experience with a reading list on college teaching.	It would be a worthy activity for CUEBS to make available such a reading list.
16. Our department offers some degree at the Ph.D. level in which a creative activity related to teaching can be used as the thesis.	

17. We have an extern program in which some of our students do some of their teaching in a different type of institution (such as a four-year or two-year college).	Less than 4% replied affirmatively. This needs to be developed.
18. We have developed a handbook for teaching assistants.	We have received very, very few handbooks and most of these would not be useful to other institutions. One of the best is used at the University of Utah.

The last page of the questionnaire was the most important--a blank page. We tried to make it very clear that we were anxious for unscheduled observations about what respondents were doing. In some cases, we learned from the questionnaire that some rather highly publicized programs melted away completely when we asked for specific details. We also learned that some very prestigious institutions have virtually no program to prepare future college teachers or even to supervise the instruction of their own beginning students.

These quotations indicate the gravity of the situation:

"Too often our T.A.'s are selected from a pool of graduate students who have not been given a fellowship or traineeship or have not been supported by a research grant."

"In comparison with other forms of support, T.A. support is offered mostly to United States students with relatively weak academic records or to foreign nationals."

On the other hand, we learned about a number of ventures worth reporting.

Conferences

Several departments have conferences for T.A.'s before classes begin in the fall. These conferences are designed to orient new T.A.'s to their responsibilities. In some cases, they also provide an opportunity to examine objectives and to develop techniques of teaching.

The University of Colorado makes good use of consultants in a three-day institute in the fall followed by four monthly seminars. It is necessary to repeat the conference for a different group of graduate students in the spring. The emphasis throughout is on inquiry-oriented teaching. The continuing program is not just a review of the content of the course but a consideration of such vital issues as evaluation, problems of the non-major, development of investigative learning situations, and educational objectives. An effort is made to relate these studies to the red-hot problems the graduate students are facing as teachers. Next year graduate students will develop their own laboratory activities and will try them out in the regular laboratories during the year if all goes well. (See CUEBS News Feb. 1970)

Those who have participated in the conference at the University of Utah say that it gains great strength by being interdisciplinary. Participants are carefully selected and are paid $75 for attending the three-day conference. Those who attend feel that one of the most valuable experiences of the conference is the microteaching experience.

At the Mississippi State fall conference they pair each new T.A. with a more experienced graduate student.

Minilessons

Televised lessons are used in the program of the fall conference at some universities[1]; others use this technique at other times. A common approach is to have the T.A. teach a minilesson (a brief portion of a lesson or a brief presentation of a single concept) and then analyze it alone, with a sympathetic mentor, or with a group of faculty and T.A.'s. Sometimes the tape is stored to provide a "before and after" picture of the growth of the graduate student as a teacher.

The television camera is only essential if the teacher is to see himself in action. Actually much is gained by careful analysis of a performance whether television is used or not. Some replies give the impression that too much attention is paid to relatively unimportant matters such as the odd mannerisms of the instructor rather than the vastly more important question: did the instructor evoke real thought and response from the students in the class? In the Zoology Department of the University of Michigan they sometimes use a split screen recording the performance of the T.A. on one side of the film and the response of the class on the other. In this way they can see whether the students are fighting to respond or to keep awake.

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1. Montana State, Yale, Florida State, Utah State, University of Rhode Island, University of Colorado, etc.

Seminars and courses

The various universities offer a whole spectrum of courses and seminars, some for credit, some not; some required, some not; some focussed on the problems of a particular course being taught by T.A.'s some focussed on teaching in general. It is common for T.A.'s to meet with the member of the faculty in charge of a course to discuss what is to be taught the next week, to work together to solve the problems which have arisen, and to anticipate the problems which are likely to arise. Ideally, these sessions furnish a forum for instruction in teaching using the actual problems and challenges as points of departure.

Some faculty seek ways to have informal man-to-man sessions involving the "old pro" with learners (University of Iowa and Iowa State, for example). The course offered at the University of California at Davis is an example of more organized, formal instruction in teaching. At Colorado State a seminar in teaching developed by the Zoology Department and open to the whole university was so popular that weekly attendance varied between 200 and 300. At the University of Nebraska 90% of the animal science faculty voluntarily attends the annual teaching symposium held in the college.

Rewarding Excellence

There are various ways to reward excellence in T.A.'s. At Oregon State the top two each year are hired as instructors. At the University of Utah they are promoted to teaching associate. The University of Pittsburgh not only promotes the best T.A.'s but increases their stipends $100 per term.

At many places the reward comes through increased responsibility. In the Botany Department of the University of Michigan and at Ohio State, Boston University, Clark University and other universities, senior T.A.'s have an important supervisory role.

The best T.A.'s at the University of Washington are chosen to work with honors undergraduates and are challenged to use the opportunity to produce something special. At Wake Forest, senior teaching assistants act as research advisors to selected undergraduates, while at Oregon State, the best T.A.'s are in charge of a summer session botany course for high school teachers. There the accent is on how best to teach the material being studied. Selected T.A.'s in the Zoology Department of the University of Michigan teach a summer course *in toto* including supervision of T.A.'s.

At the University of St. Louis they have a planned lecture experience worked out definitely so that each person has a carefully supervised and criticized lecturing experience. T.A.'s at Stanford design new laboratory exercises and each person gives a lecture under supervision. In addition, a senior T.A. has the opportunity to offer a course to be submitted to the faculty for review like any other course and if that course is accepted it is offered as part of the regular curriculum.

Externships (Internships at Cooperating Institutions)

The University of Minnesota sends both graduate students and undergraduates to act as teaching assistants in junior colleges of the Minneapolis area. In the special program for preparation of teachers for two-year colleges at Texas Tech University, candidates are required to teach for a semester in an internship program at a cooperating junior college, but they are paid for their participation.

The EPDA fellows at East Carolina University spend five weeks working with an experienced small-college teacher. During the last two weeks they do independent but supervised work with students in laboratories, lecture, and special activities.

At Sam Houston State University prospective two-year college teachers visit cooperating institutions and faculty from these institutions are used in seminars on the university campus. Extern programs exist at Central Washington State College, Murray State, Atlanta University, and other institutions, but it would seem that the whole idea could profitably be exploited much more widely.

Degrees

Some institutions are seeking ways to improve preparation of teachers within the framework of the Ph.D. program; others are seeking to provide better programs by developing other degrees.

One of the most prestigious alternatives to the standard Ph.D. is the SESAME Program at Berkeley. Here in a very selective program they have a Ph.D. in Science Education whose distinctive feature is that the thesis can be in a subject related to the teaching of biology. This opportunity is also available at Oregon State, Rutgers, and the University of Wyoming.

Dr. Robert Koenker of Ball State University has prepared a summary on the Doctor of Arts (available from CUEBS on request). While almost no university except the University of North Dakota offers a Doctor of Arts to biology students at the present time, several universities are considering it. The program being developed at the University of Illinois is imaginative. They not only have an extern program built in but they have a plan that at intervals after graduation the Doctor of Arts would be brought back to the campus for updating and refreshment.

Among alternatives to the traditional Ph.D. are the Ed.D. (Oklahoma State, Columbia Teachers College, the University of North Carolina, Ball State, etc.), the Ph.D. in Science Education (Iowa State, University of Maryland, Ohio State, etc.), Ph.D. in Natural Science being developed at Peabody especially for teachers at two-year colleges. There are other degrees such as the Specialist Degree[1] offered at such places as the University of Illinois and the University of Alabama; and many institutions which do not offer the Ph.D.

Danforth Programs

The Botany Department of the University of Michigan has been cooperating with the Center for Learning and Teaching at the University and the Danforth Foundation on a program to improve preparation of college teachers. Their program is described in Memo to the Faculty No. 37 available at the Center for Learning and Teaching of the University of Michigan. At the University of Chicago they have what they call Danforth Tutors who are junior colleagues in all aspects of teaching an introductory course. They participate in planning the course and work right along with the faculty in development and presentation of the course.

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1. A booklet describing the Specialist Degree and listing institutions where the degree is offered may be obtained from the American Association of State Colleges and Universities, One DuPont Circle, Washington, D.C. 20036

Selection of Faculty

Dr. Beidleman from Colorado State reports that when members of his department interview a faculty member for employment, they ask him to teach some particular bit of a course, not give a seminar, but teach something at the beginning level. Such concrete expressions of concern by the consumer might well have a salutary effect on the performance of the producer.

Faculty-student Concerns

Some people said, "We do not have anything truly innovative to be copied by anybody, but we are a small department and we try to get the professor and student together and work as a team. What can we write down that could be copied by someone else?" This kind of concern for teaching is something worth copying. Let me give some real quotations:

"We have had closer contact than most departments. Graduate students for the most part belong to one member of the faculty occupying a desk in his office; they are really almost teaching partners." Northern Michigan University

"The key seems to be a kind of close-knit informality..." Microbiology at Iowa State

"We start first-year T.A.'s in a lab adjacent to that of a senior staff member who is assigned as the T.A.'s mentor and supervises his teaching, criticizes his exams, etc." Brooklyn College

"We are a very small graduate department...so that our teaching instruction of graduate students is more on the personal level than in a formal program." Clark University

"Our teaching program for college teachers is conducted largely on a personal basis between the T.A. and professor." Lehigh University

Conclusion

Actually, it is difficult to determine through a questionnaire where future faculty members are being well prepared. The essential ingredient is not a special technique which lends itself to easy tabulation but some program which brings together a concerned mentor and a concerned student in some arrangement which provides a rich measure of meaningful experience and maximum interaction on matters that count.

On Becoming a College Teacher

Dr. Frank M. Koen
University of Michigan

I would suggest a fundamental error in the idea of approaching the training of college teachers is made when you ask "give me some good ideas, give me some models." I would suggest that you approach it instead from the standpoint of what you are trying to produce. I suggest that you ask, "a model for what?"....

As we consider the business of training college teachers, I would like to engage you in a problem solving situation. First, I would like to talk about dimensions of college teaching--what are the roles you are playing when you are preparing college teachers? What are the functions of college teaching? I would suggest to you six categories of the kinds of things that college teachers do. There is nothing sacred about these six categories; it is just a set that I use. You must take all of these things into account when you are really training people to be college teachers.

First is content mastery. There is a well known statement that you have to know something in order to teach it, and indeed, there is also a corollary: undergraduate teachers learn an awful lot about biology when they teach it to someone else.

As was pointed out earlier, many first year graduate student do not have the content mastery necessary to tackle the introductory course. They have already become too specialized. A training program then must have a way of determining what their mastery is and some way of doing something about it.

Second, another thing a college teacher has to be able to do is to organize a domain of knowledge, design a course, set up instructional objectives. It is not the easiest thing in the world to do. It is one thing to be a graduate student and to mak good grades when the structure of the domain you are studying has already been given to you. it is a different matter to structure it yourself, to design a course, to decide what the syllabus should look like, the best sequence of topics, how much time you are going to spend on each. This is something that ought to be part of the training. It seems to me a natural thing that you would expect every one of your teaching assistants to write up a proposal for a course. He would submit the proposal and offer a course in his specialty. He is working on his dissertation and has passed all these courses. Surely he is an expert in these areas.

The third category of things a college teacher must do is what I call management of learning skills. This is what you generally look at when you look at your teaching assistants in a laboratory, in a recitation section, etc. This involves the range and flexibility of a person's repertoire, the kinds of things he can do. I would suggest that any time you have a teaching assistant who is kept in a laboratory or recitation, or grading or discussion, he is not experiencing the range of things a college teacher should be able to do. The good teacher has a flexibility. He can adapt what he does to the situation. If somebody gets practice in only one kind of aspect, no matter what it is-- his training is inadequate.

Just as there is no medium that is the only way to present material, there is no teaching procedure which is the only way to teach. The choice of the procedure or the medium depends on the goal; the choice of your training program depends on how you answer these problems that I bring up. Decide which of these things you are going to essay to produce, and then you decide on how you are going to do it.

The fourth aspect of college teaching is the quality of the teacher's personal interaction with the students. Now I do not suggest that you teach your teaching assistants to conduct group therapy in every one of your first classes, but the fact is that you, as a human being, do come through as you are when you face any other human being. My area of psychology, in addition to good psychology teaching, is what they call psycholinguistics which has to do with the business of communication. It is physically impossible for a human being not to communicate. Everything about you communicates; everything that you do communicates. So, what I am saying is that you must be aware that the teacher is there for the benefit of the students; otherwise he is not doing his job.

The fifth is the ability of a teacher to vigorously evaluate his own teaching. The most familiar pattern of supervision is for the faculty member to come in and visit the class for 15 minutes once a term. That passes for close supervision. I think such visits are inhibitory but does that mean that your teaching assistant cannot get help? Sure he can get help: you have more experienced teaching assistants. That is what we use in the Danforth Program at Michigan.

The interesting thing about that kind of hierarchical setup is that when you use a more experienced teaching assistant, a buddy system or a group of people, the supervisor learns a lot about teaching. The way to learn something is to teach it.

I talked to the people who served in this capacity on our campus and I asked them, "How did it go? Were you satisfied with what happened? Do you think you helped the people you were supposed to be working with?"

I do not think I have ever gotten a deviation from this kind of reply, "I am not at all sure that I helped the people I was supposed to be working with but boy I sure did learn a lot about teaching in trying to help them!"

I would suggest that one of the mechanisms by which you can accomplish some of these more sophisticated kinds of things can be to have somebody try to help somebody else learn how to teach. Faculty persons in this role are like the kiss of death, partly because of the power they have over the poor student, but if you get another graduate student, the advisor comes in and says, "you should not have done that, you should have done something else" and the first thing that is going to happen is that the one who is being given the advice pops right up and says, "Why is what you suggest better than what I did?"

The teacher's instructional objectives can be judged for their appropriateness to the discipline, to the level of the students, etc. The best criteria for the appropriateness of objectives for a given course come from colleagues--the only criteria that we have.

The effective teacher is the one who sets up objectives and then his students achieve them. The good teacher is the effective teacher who achieves the right objectives--which can only be defined within the particular discipline because there is no other judge on what is the appropriate thing to be done.

Last night the question was raised, "can you really measure teaching?" -- a question raised many times. Most of the people who raise the question think that the answer is automatically "no". I would suggest that if you decide what it is you are trying to accomplish, you do make judgments. It happens very fortunately that human beings are very good at making complex judgments without being able to specify all the criteria they are using. They can make them reliably and you can even improve your reliability.

The sixth and last area is what I call professional competence. This concerns the difference between the instructor and the scholar--a man who can conceptualize what he is doing in terms of the overall education and development of the student rather than just teaching in biology, or psychology or history, etc. You must consider his productivity in administrative assignments. It does make a difference to the system whether or not he has behaved will. His ability in counseling students, the guidance of less experienced teachers, the knowledge of institutional practices on hiring, promotion, publication, public service; these are things that your college teachers need to know.

Just one last thing--we must aid in the development of a personal philosophy of education. We all have one but most often it is implicit. I do not advocate buying seven books or suggest that all your graduate students take a course in the college of education called "The philosophy of higher education."

Now that we have examined the kinds of things that the college teacher is called upon to do, let us consider the essential qualities of a program designed to produce people with these qualities. Let us also examine a scheme for designing programs, given your resources, given your students, given your faculty.

What does a program feel like? What are the qualities of any program that would accomplish something like this? I would suggest that first you would choose the appropriate ones for you as efficiently as possible. You can build a lot of redundancy into such a program and the process I am going to take you through will help you see those things. In other words, I would suggest that the program should be designed to the specifications and the specifications should be related to what I said about the dimensions of college teaching.

You have to decide what it is that you are trying to do. Is it the case that your graduate students, when they finish, will have to give lectures? If so, you had better find some way of giving them some practice in the organization of lectures whether you think that lecturing is good, bad or anything else. There is a difference in what you do when you are organizing the material for a lecture instead of a lab session or a recitation.

You need something in the system for accumulating information on a regular systematic basis so that every time a new faculty member comes on the scene, you do not have to start the whole process all over again.

The training scheme must be set up to operate efficiently in spite of changing populations of teaching assistants and faculty advisors. Hence the need for records of what was done, what the rationale was for doing it, what evidence was collected, what the evidence said and what revisions were made on the basis of the evidence. These do not have to be extensive and voluminous but they need to be systematic.

The third thing to consider is the scheme for designing a program. Let us take a goal through the process as an example: in this case, the fact that I want a teacher to feel comfortable is the goal. It is common for people who are working with new teaching assistants to want them to feel comfortable. I hope none of you feel that is trivial. It certainly is not trivial for a beginner because he does not feel at ease at all the first time he gets in front of a class.

All right, that is a goal. Now we are going to see how we design a program to achieve that goal. What kind of evidence do we look for that would demonstrate that a new teacher has become comfortable with the class? One would be his flexibility, i.e., he comes in with a lesson plan or a set of notes but he is not bound to it. If it does not seem to be working, he changes it. Secondly, he does not have many nervous movements: he does not sweat, his voice does not quaver, etc. He is comfortable. He interacts with the people; he does not brush off student inquiries and comments because they do not fit in with his plans. He does not use sarcasm (a sarcastic person is a threatened person). He does not feel the necessity to assert his authority improperly. He looks the students directly in the eye.

After the class, if he talks with somebody who observed his class in which, let us say, a minor disaster has occurred, he does not get defensive about bad results: if he blows it, he just blows it, that is all.

You can see another aspect of the comfortableness of a teacher--it is his accessibility to the students. The way you protect yourself from the class is to come in exactly at the beginning of the hour, stride up here to the podium, put down your books, do your thing and then exactly at the end of the class stalk out. That way you never have to interact with the student.

Where is the evidence gathered? The evidence that the student is comfortable has to be gathered in class because that is where the directly relevant phenomena are.

What kind of mechanisms could we possibly think of to do this thing? We know the kind of evidence we must have. How might we do it? I thought of about four or five and if you buy any of these as "Yes I'll do that", then it is a gimmick. If you think about it and you see what I am talking about as illustrations, then it is useful.

The first one that has occurred to me is that you could use what you call a "microlecture"--ten minutes of giving a microlecture to a set of other graduate students (or better, undergraduate students). Let the T.A. view the tape in private to see what he is doing, then put him in conference with a safe person. Most of the time that is not going to be a faculty person; another graduate student would probably provide a better way to find another human being's reaction to what is going on.

Secondly, you can give him practice in making a presentation in some kind of college teaching seminar. You cannot talk to him about lecture techniques; he has to lecture. You could have a college teaching seminar sort of like a workshop in which you practice doing it; this way you build up a trust with the other set of graduate students.

Sensitivity training would be one way to teach a person not to get up tight about the effects that he has on people if you would have facilities on campus. I am not pushing sensitivity training, I am just saying that these are possibilities.

Another way is simply to sit in the class of other people and see what they do. There are two situations where the observation of other teachers is particularly useful: one in which you know the content so you could not care less about what he is saying. All you do then is pay attention to what he is doing. Alternatively, you can observe a class in a discipline about which you know nothing. So what you are forced to do when the jargon is strange to you and you do not know what they are talking about is to pay attention to what is happening. It is very helpful, it really is. Remember that your goal is to have your teaching assistant be comfortable. You want him to see how other people interact. He is not going to copy anything and you do not want him to copy anything; you just want him to pick up new pointers.

Another way to make the graduate student comfortable is to concentrate on the content so that he is sure of what he is talking about. Almost universally graduate students respond to this well. It makes them feel more comfortable to know what they are talking about.

It probably does little good to lecture the teaching assistant on how to relax in class; he needs practice in performing in the desired manner.

Finally, our program for preparing college teachers is not complete until we have compared the actual results of our program with the goals we set. Then we have to make appropriate revisions in the goal, the method, and/or the kinds of evidence collected. We must be explicit when we reach this comparison-revision phase; it is not enough to flatter ourselves with vague generalities.

* * * * *

At this point, Dr. Koen was interrupted by a flood of questions. One statement made by Dr. Koen in this exchange was so significant that it must be part of the record. "Teaching assistants who are teaching on university campuses are de facto college teachers; they are not future college teachers. They are teaching right now. You who supervise them have a double responsibility. You have a responsibility to the undergraduates on your campus, and you have a responsibility, God knows, to the undergraduates whom your graduate students are going to be teaching when they finish and go somewhere else."

Alternatives to the Ph.D.

A Panel Discussion

Dr. E. J. Boell, Chairman
Yale University

The aim of graduate education is two-fold so far as the individual graduate student is concerned. It is to acquaint him with the achievements and knowledge of the past so he can transmit them to future generations of students. At the same time it is to provide him with the technique and with the abilities to produce new knowledge and to make new achievements. The first of these aims obviously relates to the development of individuals with backgrounds for teaching and with competence to transmit as teachers the information and the knowledge and the inspiration they have. The second of these aims of graduate education, it seems to me, is devoted to the research activities of the individual. I think it is true in general of graduate education in this country. It is certainly true of Yale which is devoted primarily to the production of the research scientist.

The professor is interested primarily with going through the process of replicating himself and producing in his student someone who is essentially created in his image. I think that the production of research scientists is a very important obligation of the graduate school because only through the developments of a very broad base of new understanding of scientific facts, the new accumulation of data, the analysis and the integration of these data can progress be made in biology. We really cannot focus on a given end result, I think, so far as the potential applicability of the general research achievements that we produce is concerned, hence what we do is to develop a very broad base of biological data and hope that the prepared minds can in some way see the relevance of a particular piece of data of a particular observation to a particular problem. It is important for the university to continue its role in introducing new creative scientists; the research element is therefore extremely important.

I think it is also true that in many places the emphasis has been so predominantly on the production of the research scientist that there has been too little attention given to the qualities of the individual as a teacher. I am pleased to note

that I think that there is a change in the kind of emphasis that is now occurring. That we need a change in emphasis is obvious. When you look at the abilities of some of the research scientists or their real interests or commitments to teaching, I think we have to admit the abilities, commitments and interests in teaching are in many cases wanting.

The research scientist reluctantly and grudgingly goes to his classroom sometimes unprepared to deal with a particular subject, and then rushes to his laboratory to pour out more data. But students are rebelling against this kind of thing and faculty members are beginning to see that the second obligation of paying more than lip service to teaching and paying more than partial attention to preparation of teachers is very, very important.

Now, because of this change which has been going on for some years, there has been some question raised as to whether the Ph.D., the research degree, actually is the only degree, the only appropriate or necessary degree to indicate the qualifications of an individual for teaching. It is not. The most eminent professor of biology in our department does not have a Ph.D. degree, but he is the most outstanding teacher in terms of the production of important individuals in his area that we have in this country, perhaps in the world. His competence as a teacher was not the outcome of a particular method of pedagogical preparation or training but because he was committed and devoted and had something he wanted to say.

I think at the outset we can say a Ph.D. is not necessary so far as making a good teacher is concerned. But a Ph.D. has certain necessary qualities about it, not to improve the teacher but to improve the faculty members' recognition as a teacher. At Yale the fact that we have two non-Ph.D.'s in our department does not make a particle of difference so far as the accreditation of our department by the agency accrediting in this area. In some institutions where the staff of biology is one or two or three layers deep, whether the staff has Ph.D.'s is a very important question.

There are two aspects to this problem: (1) What does it take to make good teachers? (2) What does it take to make people who accredit institutions recognize these individuals as qualified to teach? The real problem is trying to convince the accrediting agencies rather than in trying to produce teachers.

I have only a few additional words to say in the way of introduction and that is to outline something that has in recent

years been done at Yale. In recognition of the fact that the research training leading to the Ph.D. may not be the essential component in the preparation of a teacher, some years ago the graduate school recommended and the corporation approved a new master's degree program, the Master of Philosophy degree. This represented all the work of the doctorate except the dissertation. It involved taking all the courses that our Ph.D. students normally take, taking the comprehensive examination and passing it and therefore being essentially declared a candidate for the Ph.D. degree. Such individuals it was claimed (experience has shown) have all of the formal training in subject matter that Ph.D.'s do and should be qualified to teach.

We have used in our department and elsewhere individuals with the Master of Philosophy degree as teachers in some of our undergraduate courses, not just the introductory course but also in advanced courses. There are two outlets for these individuals in addition to the use as teaching fellows. One of these outlets is their appointment in the department as acting instructors or their being recommended to a number of participating institutions as teaching interns.

Now the problem of being satisfied with an M.D. or something short of the Ph.D. is not only accreditation but it is also, so far as the individual is concerned, money. For six years I was on the board of education in my town and I know that the master's degree then was worth $500.00 for a year of salary. The person may have been a lousy teacher but because he had a master's degree contrasted with someone with a bachelor's degree who might have been an extraordinarily good teacher he got during the ten months of school year $50 a month more. If he had a six year preparation or a doctorate of education degree (even through the speciality of that degree was administration and not teaching) he would get a certain number of dollars more than the masters and a certain number of dollars more than the bachelors. Yet, he may not have been any better of a teacher; he might have been a worse teacher by having focused so much on administration instead of subject matter.

There is a problem. The doctor on the title means money to the individual, and we can't lightly isolate the prospective teacher from income. Our problem is twofold: either to invent a different degree that does not focus so much on research but can carry appropriately the title of doctor or else to convince those that have to do with accreditation and those that have to do with budgets, that this person should be paid a certain salary because he is a good teacher and not because he tacks on after his name a certain number of letters.

Dr. Edward C. Moore
Massachusetts Board of Education

I would like to talk for a minute about one of the new degrees proposed - a Doctor of Arts degree.

I should perhaps say that I was a graduate dean for six years and graduate vice-president for two years besides being one of those philosophy graduate students at Michigan, so I have some experience with these problems. I am going to make some kind of strong statement; I think I ought to stir you up a little bit. My own feeling (and I think that of many people in graduate education aside from graduate faculty who have their own peculiar views of life) is that the teaching assistantship is a poor way to prepare people for teaching. In fact, to call it teacher preparation is a misnomer because it does not really prepare anybody. In most institutions you just sort of throw the student in and see if he can swim; if he does not, he drowns.

There are many courses offered for the supervision of teachers and all I can say is that I have not seen any yet that seem very satisfactory. Besides its inadequacy, it seems to me that there is a high degree of immorality involved in teaching assistantships. We are, I think, unfair to the graduate student. He has more important things on his mind, at this point in his career. He is slowed down in getting his work done and I am not sure that he is that competent in his material that he ought to be teaching. And, of course, as everyone knows, teaching assistants are underpaid. They do not get any credit for their work and the receipt of his degree is in no way affected by it. So, very simply, to mix a metaphor, it seems to me that we sneak the T.A.'s in by the side door and hide them under the rug. I do not look on the T.A. as in any way a satisfactory device for preparing teachers and I think that institutions are basically immoral if they protest that it is a device for this purpose.

I never accepted criticism of the teaching assistant when I was a graduate dean because I said I was not preparing people to be teachers. And I want to emphasize the point that Dr. Boell was making: as far as I'm concerned, that Ph.D. is a research degree. The student who is working as a teaching assistant is no different as far as I am concerned than if he were working as a clerk in a local grocery store. It is irrelevant to his Ph.D. program.

I think from what someone said this morning that maybe biologists ought to know that 50% of the people who get Ph.D.s do not go into teaching. Maybe this is not true in biology. [1] So if the Ph.D. itself were modified to having a heavy emphasis on teaching, this would be just as unjust for those who are not going into teaching as the present neglect of the concerns of those who will teach.

For this reason, among others, there has been a good deal of concern in what has been called the Doctor of Arts degree. It is a degree essentially similar to the Ph.D. but without the dissertation. Substituting for the Ph.D. is a third academic year of study at the graduate level involving a fairly major project but not of a research sort.

This document in my hand is the version of the Doctor of Arts degree that has just recently been approved by the American Association of State Colleges and Universities.[2] It has received a fairly definitive structure now and it is an ought to be looked at very carefully and I think has a great deal of merit.

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1. Actually 69% teach, according to Humphrey and Wise, CUEBS NEWS, December, 1969. Ed.
2. American Association of State Colleges and Universities. 1970. The Doctor of Arts Degree: A Proposal for Guidelines Available at One Dupont Circle. Washington, D. C.

Dr. Trevor Colbourn
University of New Hampshire

I may be just as provocative and perhaps less constructive in some respects than my colleague. Let me state very briefly that I think there is some agreement in terms of the expressions that have surfaced thus far in terms of the deficiencies and limitations that some of us seem to feel regarding the Ph.D.

I suspect that most people in this room have survived that particular obstacle course, and there is, I think, on the part of at least some graduate faculty a proclivity to presume if they had to suffer, shall their students go through exactly the same kind of tortures. I think, in all fairness, though that this is an attitude shared decreasingly by graduate faculty who are increasingly sensitive to the deficiencies in the character of the Ph.D. and are very much concerned with just how these deficiencies could be redressed.

I do not want to dwell on the deficiencies beyond observing that certainly it would seem that the overwhelming majority of Ph.D.'s in all disciplines do go into education if not on the teaching level. I do realize that this is a percentage that varies in some disciplines but I do suggest that before you dismiss yourselves as not being involved in this fashion that some additional homework be attempted.

I had a rather warm debate with a chairman of my own chemistry department of New Hampshire who told me that most of our chemistry Ph.D.'s went into industry and therefore the Ph.D. was fine for them. He said that he himself was particularly interested for the future in attracting additional graduate students who were interested in college teaching but for whom therefore a very different degree was appropriate. We did some homework to find out whether such assumptions were valid and discovered that approximately 85-90% of the chemistry Ph.D.'s ever granted by the University of New Hampshire were held by college teachers, and I would add that most of the positions are at extremely reputable, highly respected institutions of learning nationally.

The question then arises as to whether they had been adequately trained for the career that, in practice, they adopted. The answer has to be no; if they are doing an effective job in the college classroom it is more by accident and our good fortune and theirs then by design or by skill or by serious attempt to address their career needs. I am well aware

that there are teaching assistantships in virtually all departments and I am well aware from the studies which have been undertaken for biology that in many institutions the teaching assistantship is taken more seriously and that there is an attempt to provide some direction, some guidance, and in the larger sense some education, some training to teaching assistants. But I think that we still have an enormous distance to travel to meet that particular objective.

There is, as far as I can discover, only rarely serious attention on the graduate level to career preparation or to professional preparation as opposed to research or discipline preparation. I think that it is this fact that has led to serious consideration of alternatives and particularly to the current fashionable concept of the Doctor of Arts degree.

I am going to say very flatly that at this point I still need to be educated and persuaded as to the merits of the Doctor of Arts as the answer to our needs. And I do regard myself, naively perhaps, as educable, and were I to stay perhaps I might well have been educated. [Dr. Colbourn had just received a note calling him away on an urgent matter.] I am aware that some of my fellow panelists are very fervent proponents of the Doctor of Arts as a desirable alternative.

Just for the benefit of succeeding conversation and dialogue let me just explain very briefly my reservations. Perhaps they can be dispelled and then I can get the minutes and find out why and then reconsider. My biggest reservation on the Doctor of Arts is frankly pragmatic. To a point (only to a point I shall concede) a doctorate holder is as good as the ability of his department to place him reasonably, and right now this is by no means an academic point. As you well know, in many disciplines there is a serious surplus of Ph.D.'s on the marketplace desperately scrambling for relatively few positions. I think that this has been over publicized in the wrong way and I think that it is one of the reasons we are suffering from embarrassment in Washington. Nonetheless, it is true that the marketplace has shifted, that there are many fewer positions available this year than last, and there may be still fewer next year the way things are going right now.

I think it a useful illustration to recount that the University of Washington, at the end of last year, was seriously considering a series of Doctor of Arts programs. To that end it conducted a very serious study of its own marketplace: the community college and junior colleges for whom it contended its Doctor of Arts holders would be primarily destined.

The results were rather startling. The results indicated that the community colleges and the junior colleges who were expected to be just lusting for Doctor of Art's candidates said in effect, "No thank you; we can get all the Ph.D.'s we want at this point. Ph.D.'s carry prestige and status and we need both."

I am not arguing that the responses are necessarily correct responses; I am contending that this response signified something. It signified that at the present time there is the assumption in many quarters that the Ph.D. is a prestigious degree even if it is not perhaps the one that incorporates the proper training or the right balance of training. The Ph.D. is a prestigious degree; it has currency and will be respected. There is also the assumption that the Doctor of Arts is not in the same category, that because it will not be and cannot be, the Doctor of Arts holder is going to find himself in a very difficult position. He is going to be foreclosed from many possible appointments. He is going to be operating in what is presently, at least, a rather fragile marketplace.

I agree that things can change. It is possible that the community colleges and the junior colleges will see the light and realize that a man with a Doctor of Arts degree could very well be much more suited to their needs. But nonetheless, they do not see it that way, and since efforts to persuade them to the contrary have not yet apparently made much headway, the holder of the Doctor of Arts is going to be at a serious disadvantage compared to the holder of the Ph.D.

Moreover, the Doctor of Arts as conceived, is not something that could be readily converted into the higher currency. In short, the holder is in a box from which there really is no easy emergence. He either has to accept the second-hand status (because this is what seems to be entailed) or he has to start over, which is a pretty high price and not a very rational one. I am raising questions about the acceptability, about the real marketplace for the Doctor of Arts. I am not so much questioning the virtues that the program can incorporate. The matter of status is, rightly or wrongly, a relevant issue to the academic marketplace. It is there.

My own conclusion at this point is that the virtues of the Doctor of Arts, which are real, can and should be incorporated into the Ph.D. I feel that this is by no means an irreconcilable proposition. More challenging and more perplexing at times is the necessary task of persuading graduate faculty that this is a desirable development.

I think that those who contend the Ph.D. today is an irrelevant degree have too often a justification to their complaint. I would hope that it might be possible for graduate deans and graduate faculty to work closely together in the future and find ways to remedy that complaint, to reform the Ph.D. to make it a relevant degree. They must not be hung up so obsessively with the research component but pay more heed to the crying need for professional preparation for the college career for which most holders of the doctorate seem to be destined.

I would still argue for research competence. But I don't think that it has to be quite as large in its final dimensions as presently is usually required. In many disciplines it is a fact that 80-90% of Ph.D. holders, once they get their degree, publish nothing except their own name occasionally. In other words, for many, the Ph.D. is a terminal educational experience, at least it seems that way from at least one vantage point. This being the case, why is it we spend such an extraordinary amount of time on the dissertation? Why is it that we do not at least apportion a part of that time to the area of educational preparation, and professional training, so that a Ph.D. holder will go into the world knowing what world he is going into, knowing why he is going into it, and prepared to meet students and understand them and respond to them and meet their needs more effectively?

As I said, this is one position. It is not necessarily one endorsed by my own faculty, even necessarily in my own office. But I feel nonetheless that at this point the hazards facing the Doctor of Arts are serious, that it is willy-nilly emerging as a second-class degree, fairly or not. I feel that the holders will be at a serious disadvantage. Since the Ph.D. has currency, I think it would benefit us to improve that, make it more relevant, make it more pertinent to the needs of not just the marketplace but to the holders and to the students whom they will be teaching.

Dr. Alex Henderson
Millersville State College, Pennsylvania

I find it hard to take issue with Dr. Colbourn. He actually speaks very well for the small college whose name is not Yale, Harvard, Brown or Princeton -- for the people who do have to be concerned.

Perhaps this is not relevant and only shows that I am getting old, but I have been around long enough to see the pendulum swing back and forth a couple of times. When I began teaching in the state colleges of Pennsylvania, one of the requirements was that everyone that was hired have at least three years of public school teaching experience. This was when we were a single-purpose institution. It was believed that if one were to teach teachers then he should have had some experience in teaching himself. Now I remember I was one of the young breed who protested this provincial and non-academic nonsense and was responsible at least in part for having it modified to include any kind of experience.

Now that we are a liberal-arts multi-purpose institution the faculty is not required to have any teaching experience whatsoever when they are hired. When I began as department chairman, and was searching for respectability, of course I was anxious to hire young men who had their Ph.D.'s and who preferably had a couple of papers published and who had distinct research interests. For a while this worked fine because with the older staff members that we had, we had a nice complementary balance of both research and teaching. Then, I began to develop more concern with other aspects of the candidates because I had some difficulties with some of the young Ph.D.'s who had no teaching experience whatsoever. I still hire young Ph.D.'s but I am increasingly concerned about teaching ability.

My assumption is that I was invited to this conference to speak from the view point of the consumer and, of course, that is exactly what we are. We are a part of a large group of small colleges which employ the products of most of the universities represented here.

A number of questions and considerations arise in relationship to the alternatives to the Ph.D. First, we might consider what the alternatives are and I think we are all familiar with these: the Doctor of Arts, the Specialist Degree, and Master of Philosophy that Dr. Boell mentioned or other designations that are somewhat less known -- the Doctor of Education for example.

The second consideration is less well documented in spite of very recent efforts by CUEBS staff and that is why there should be an alternative to the Ph.D. We are probably all familiar with the panel on college instructional personnel which was formed in June of 1966 and the report of the sub-panel which suggested that the graduate education of today tends to be too restrictive, that emphasis is on specialization, and that the Ph.D. research dissertation is consuming a disproportionate amount of the graduate students' time. This group recommended a greater breadth in training and more attention to scholarship, however that might be defined. The sub-panel according to my understanding, concluded with the recommendation that an alternative degree to the Ph.D. not be formed.

At the recent conference of biology department chairmen held at our school we discovered that the majority of the small colleges in Pennsylvania, Maryland, and Delaware were engaged in undergraduate research to some degree or another and the chairmen who were there indicated that ability to do research or the publication of papers was considered an important part of the credentials of the young Ph.D. or the young staff members that they were going to hire. All of the chairmen admitted, however, that teaching was the prime factor in any staff member that they would hire and that they would prefer excellence in teaching above all.

The question which has been batted around for years has been research versus teaching or whether it is a "versus" situation at all. Is the creativity which makes the researcher great the same creativity which makes a teacher great? Related to this, is the lack of creativity which is found in many or maybe most researchers which really makes them technologists or dilettantes--the same lack of creativity that produces the dull, uninspiring teacher regardless of what pedagogical training he might have?

My own prejudice is that I as a consumer want inspiring or at least diligent teachers and perhaps a special degree program may provide them. But, I am afraid that any other degree will reach the state of the Doctor of Education degree. Some of you may have read the article "Teaching versus Research" by Horace Davenport of the University of Michigan.[1]

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1. Davenport, H.W. 1970. BioScience 4:228.

I just want to read part of one little paragraph here and to conclude. He says,

> "Since it is essential that the man applying for a job at East Cupcake State University or St. Elsewhere College be allowed to call himself doctor, these are the reasons I support the move to create a degree of Doctor of Arts which has no nonsense about research in its requirements."

If the rest of the academic community feels like Dr. Davenport, I don't want anything to do with the Doctor of Arts degree.

Mr. Barrett Rock
University of Maryland

I would like to just say that when I arrived last night I very definitely felt that there was a need for an alternative to the Ph.D. After hearing the discussion this morning and listening to Dr. Colbourn, Dr. Henderson and Dr. Moore, I feel that what we really need is perhaps a reformation of the Ph.D.

I can use myself as an example because I am a teaching assistant. I find that within our department, the botany department at the University of Maryland, teaching is considered a cross which must be borne. This is perhaps a generalization but the characterization of T.A.'s as slave labor is rather an adequate use of the term.

I very definitely feel that I am primarily interested in teaching. The major reason that I would like to receive the Ph.D. degree is so that I may teach at the college level. I enjoy teaching and receiving monetary reimbursement for this. I have also an interest in research but I feel that all of the emphasis in the Ph.D. program as I know it is on research and there is no emphasis on the person who wants to teach. I feel that this is unfortunate and that is why I said that I really feel that there should be an alternative to the Ph.D.

Now I feel that maybe what is needed is more of a reformation of the Ph.D. program. The person who wants the research aspect and does not intend to teach may fulfill his desires within a Ph.D. program as it now stands. A person in my situation could satisfy his needs within the same degree, perhaps just a slight deemphasizing of research.

Foundation Support for the Preparation of Better Teachers in Higher Education

A Panel Discussion

Chairman: Dr. Alfred F. Borg
National Science Foundation

The preparation of graduate students for teaching must take place on two levels. First, we must realize that the assistant is affecting very directly the students he faces each day in the classroom or laboratory. In terms of the interests of the Division of Undergraduate Education of the National Science Foundation we are very much concerned with what he is doing with students right now. He is an essential feature of the educational experience the students are having. If he is good, they benefit. If he is poorly trained they suffer. Second, we have an obligation to develop in graduate students a high degree of competence for a major teaching role later on. They are destined to replace us in our universities and if we are to make progress we must insure that our replacements will be better prepared, better motivated, and more competent than we are.

We at the Foundation could accept proposals now for doing something about improving the quality of the teaching done by teaching assistants. If you have a good idea, we can handle it--through our Special Projects Program if there is no other way.

Several different existing programs in UES can provide support for graduate assistants. The Science Curriculum Improvement Program is one example. Most of these projects involve devising better teaching materials and classroom testing of them, activities which often involve substantial work by graduate assistants. Their support can be written into the budget.

We are almost surely going to begin supporting research type grants in education. Let me read you a recommendation from one of our advisory bodies. "We urge particularly that the technique of the research grant be used more aggressively for the support of faculty and their graduate students whose interests lie in bettering the teaching of science, in studying the interaction of science technology and public policy or in other areas in which increased understanding may help us to better use science and technology for the general welfare." I

think that recommendation is sure to be implemented. As a matter of fact, we would like to see activities of this kind funded at about the $2,000,000 level in 1972 with a million dollars added each of the next two years.

We are probably going to initiate COSIP type grants under which teaching assistants can be trained. Let me provide a little background. The College Science Improvement Program is one in which we make block grants to liberal arts institutions for doing all those kinds of things needed to upgrade instruction in science. They can ask for anything except scholarships. I think it is very likely that we will be expanding this program to include non-Ph.D.-granting departments in Ph.D-granting institutions. Under such a program it would be possible to obtain a block of money to do any of a great variety of things aimed at raising the quality of teaching by both faculty and teaching assistants.

We had some discussion yesterday about other types of degrees, what are sometimes called practitioners degrees, a Doctor of Arts and so on. I think this movement is strong; it is not going to be turned aside. The trick is to make sure that adequate quality is built into programs and that practitioners degrees do not become a dumping ground for disposal of the mediocre. I think it is a losing battle to simply try to fight off or disregard alternatives of the Ph.D.

A good deal of our discussion this morning has dealt with quantitative matters, i.e. the number of fellowships available, the level of support, etc. From the standpoint of the Division of Undergraduate Education these quantitative matters are of less importance than the quality of what is being done. If and when you submit a proposal to us for support of a project to improve the training of teaching assistants, we will be sure to ask questions about the qualitative aspects of your plans. What is it you are going to do? How is your project going to make your teaching assistants better teachers of those undergraduates who are facing them every day, the students who are subjected to their daily ministrations? If the quality is lacking the quantity is meaningless. I am repeating a truism, but it is worthy of the additional emphasis.

One more point. I would like to know where one goes in an institution to get some real improvement of what is done with the T.A.'s. Do you go after the T.A., after the faculty member who supervises his work, after the department head, after the

dean or after the higher administration? Who is it that is really the key person here or how many keys do we have? I do not think that just providing additional teaching assistantships or putting in some kind of bonus on a teaching assistantship, is going to solve our problems. I suspect very much that the dean level is very important because he is usually the one that controls the flow of funds and thus influences the general atmosphere in which the school operates.

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(Here the audience volunteered answers to his questions including this one.

"Don't let anyone off the hook. We are all in this together --the department head, the dean, the graduate student, the faculty member. Without the best effort of each one, all working together, you can forget about trying to improve teaching.")

Dr. Fred S. Honkala
National Science Foundation

I want to tell you something about the support available for graduate students because without this support the job of producing college biology teachers would be more difficult. I do not think it is any news to you that there has been a marked decrease in federal support of graduate students in the sciences. The NSF traineeship program, for instance, has no new traineeships budgeted for Fiscal Year 1971. NASA, which until a few years ago, supported more than 1,500 students, is for all practical purposes, out of the traineeship business.

It is my understanding that this diminishment of federal traineeships is not intended to be a reduction of support of graduate students but rather a change in the method. One way of doing this would be for the federal government to lend money to certain corporations established for this purpose, and they would in turn provide the money at low interest rates to colleges and universities which would lend it to students. The students then, would use the money to pay their bills to the university. The university would thus benefit as would the students. Obviously, this is a different philosophy regarding the support of higher education. I have not heard much yet about the implementation of it, but I suppose something of this sort will take place in due course, although it does seem that the federal government at this moment is rather busy with a number of other things.

The fact of the matter is that traineeship programs have been curtailed, and we can only hope that something else will take their place. It may not even be the loan programs that I described previously, which may be directed more toward undergraduate students.

To change the subject, I would like to tell you a little about the education part of NSF. The National Science Foundation has a number of major parts including Research, Education, Institutional Programs National and International Programs. Of these, Research is the largest and Education is the second largest. Within Education there are three subdivisions: pre-college, undergraduate, and graduate. Sometimes the interfaces between these divisions are hazy; there is bound to be some overlap.

The status of traineeship and fellowship programs at NSF and elsewhere is shown in Table 1 which is a rough and quite unofficial compilation. From it can be seen that NDEA fellowships dropped

from a high of 12,269 to 8,600 in Fiscal Year 1971. There are possibilities for biology teachers under NDEA or AEC, but note that AEC has also had a recent decrease in fellowships. The main type of support from the National Institutes of Health and the National Institute of Mental Health comes through their training grant programs, through which graduate students are supported. But some of these programs are also being curtailed and limited. The Federal Water Pollution Control Agency (FWPCA) in the Department of the Interior has a limited number of fellowships of possible interest to biologists.

The graph presented here depicts the numbers of stipends offered in the various NSF programs that relate to graduate students, including the Graduate Fellowships, Graduate Traineeships, Cooperative Graduate Fellowships (now discontinued), and Summer Traineeships (for students who are graduate assistants during the academic year). The total length of a bar represents the number of applications; the bottom part of the bar is the actual number of awards.

Table 1. (Unofficial) Compilation of Traineeship and Fellowship Support

	1969	1970	1971	1972	1973	1974
NDEA	(2,904 new) 12,269	8,600	8,600			
HUD	100	100	100			
AEC	549	506	362			
NASA	1,262	481	436	16		
NIH	1,500	990	834			
NIMH	800	790	505			
FWPCA	690	690	690			
NSF trainees	5,238	5,123	3,342	1,719	893	0
NSF fellows	2,202	2,220	2,530			

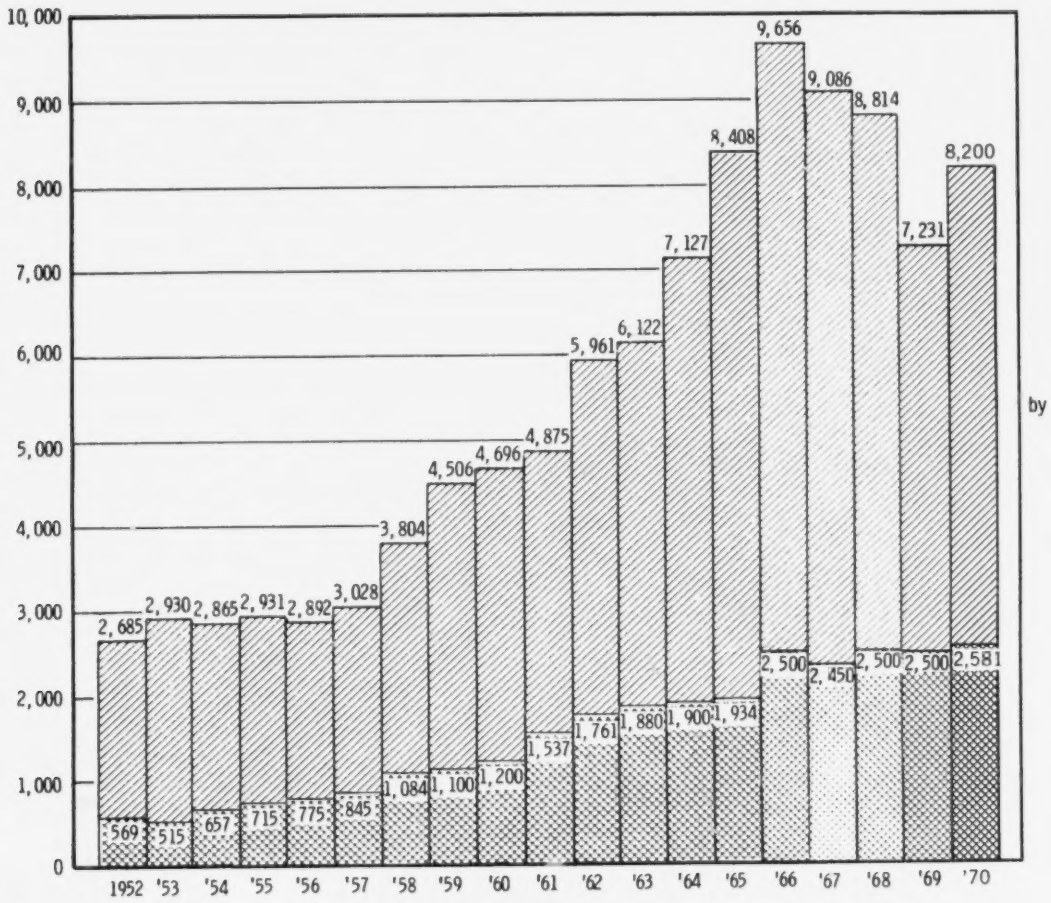
(May 1970)

NATIONAL SCIENCE FOUNDATION

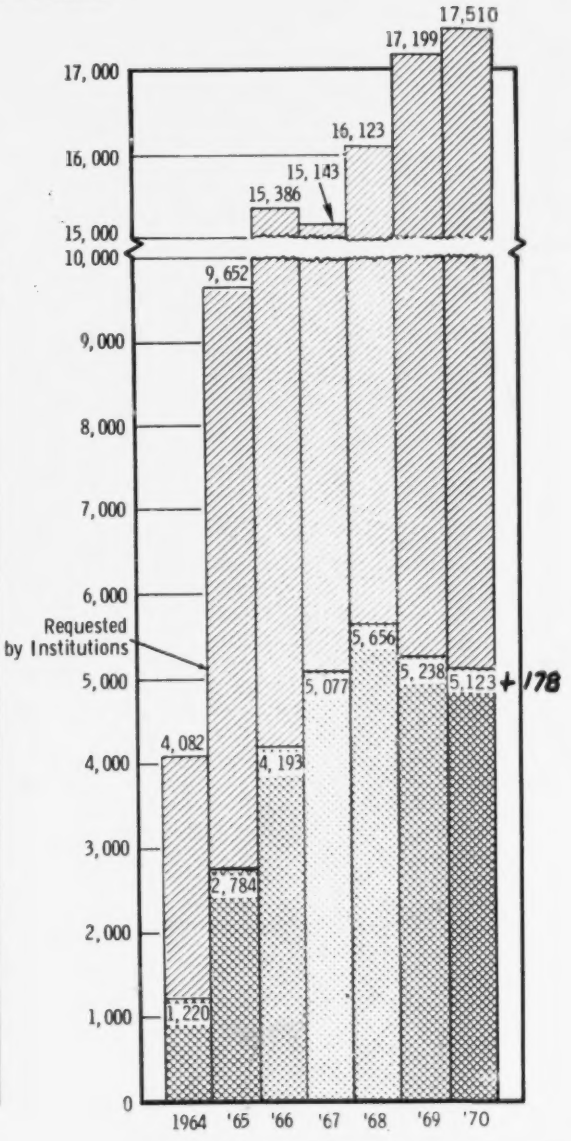
DISTRIBUTION OF FELLOWSHIP AND TRAINEESHIP AWARDS APPLIED FOR AND OFFERED

APPLICATIONS
AWARDS

FISCAL YEARS 1952 TO 1970



GRADUATE



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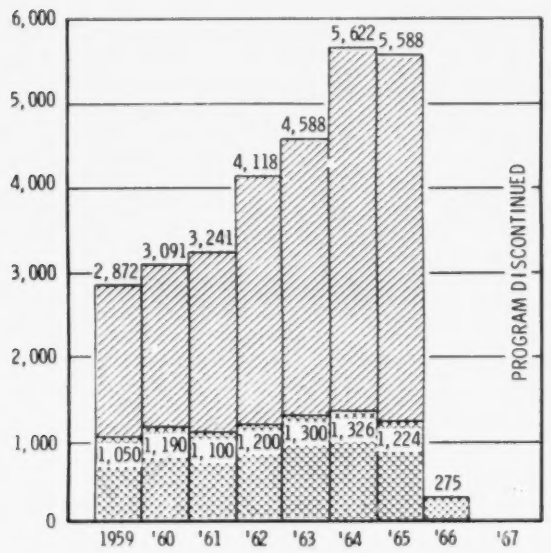

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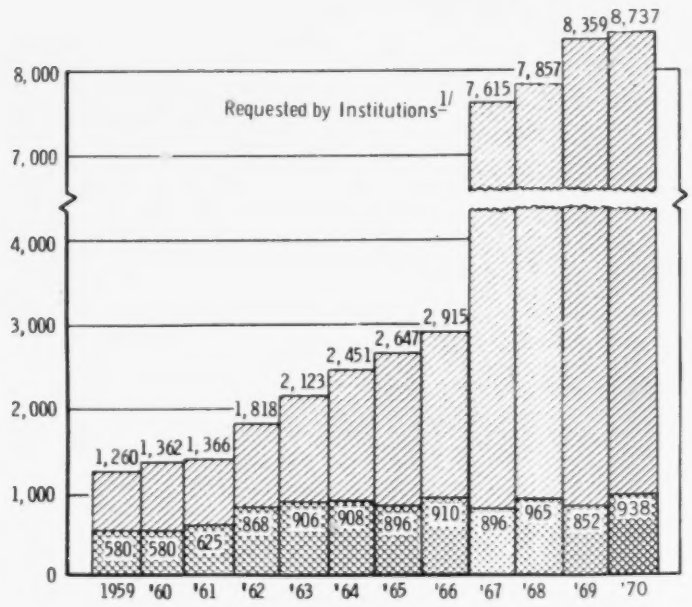

TEACHING ASSISTANT

(SUMMER TRAINEESHIPS)

1/ ADMINISTERED AS FELLOWSHIPS PRIOR TO FY 1967.

3/15/70

There are other specialized fellowship programs in NSF which are not shown in the accompanying graph. The one that I think would be of most interest to younger teachers is the Science Faculty Fellowships, because this type of fellowship recognizes an applicant's need as well as his accomplishments. With such an award a faculty member could go back for a year of post-doctoral study, or he could do some research, or he could even, in certain instances, complete his Ph.D. degree, if all that he needed was an extra year. These fellowships, then, are for the younger and less established faculty members.

Let us come back to our discussion of NSF graduate student support. In 1969 there were 1,535 new NSF traineeships, and in 1970 there are a few more (1,897), but present plans are that by 1974 there will be no traineeships in force. NSF Fellows show a slight increase, and as far as we know, the Fellowship program is in our plans for the future and we hope that it can be increased modestly as we go on.

As you know, NSF Fellowships are won by students in national competition and the students can take them anywhere they are admitted. Actually, 17 colleges and universities enroll 80 percent of the Fellows. Traineeships, on the other hand, are awarded to universities which, in turn, award them to their students.

There has been a considerable amount of debate and discussion on the supplementation of NSF traineeship and fellowship stipends, as well as other types of federal fellowships. For NSF, at least, we have recently concluded that in the first year of residency at the fellowship or traineeship institution, regardless of the level of study, supplementation may be no more than $1,000. But in the second and subsequent years supplementation will be permitted according to institutional policy. Thus, NSF fellowships and traineeship stipends can be increased if the institution wants to increase them and is able to do so. Also, until recently NSF fellows and trainees could not receive G.I. benefits but that has now been reversed by Congress in a recently-passed bill which has been signed by the President.

We have recently held meetings with graduate deans across the country, and among other things, we have discussed with them several new areas of activity into which NSF might possibly venture. One of these is science education, per se. We are not thinking of education as viewed by schools of education but rather of science education as viewed by science departments. By saying this, we do not wish to denigrate the fine work done by some schools of education in science education. It is quite possible that NSF may, in the not too distant future, have specific

programs in this particular area. The fact of the matter is that a number of proposals that come to my office can best be described as science education. For example, a recent grant we made was for the study of the techniques used by an eminent teacher of mathematics who has had far more success in producing top-notch mathematicians than most other mathematics teachers have had. So if we can find out what made him such a great teacher, the answers can be publicized and they might be helpful to others.

As biology teachers I am sure that you are interested in the fact that Dr. McElroy, the new Director of NSF, is a biologist. He is actively interested in new approaches and is willing to tackle new projects that might seem controversial to some people. One of these areas is that of student-initiated-research projects; a program at the undergraduate level has already been established, and guidelines are being written for a program at the graduate level as well. You might ask why the student-initiated research projects should not be in the Research part of NSF rather than in the Education part. We view practically all of the proposals developed by students as being in the province of research training; we do not visualize any major research findings coming out of these projects. Needless to say we are venturing into this whole area rather carefully.

In conclusion let me say that the prime concern of NSF is, as it always has been, the welfare of science and engineering in our country. Most of NSF's activities are carried out in partnership with our colleges and universities. If business brings you to Washington, please be assured that you have a standing invitation to visit with us at the NSF offices at 1800 G Street.

Dr. Laura Bornholdt
Vice-President
Danforth Foundation

My credentials for being with you are certainly shaky: I am not a biologist, I am not from New England, and it is the exception rather than the rule for the Danforth Foundation to operate in fields related to science.

The justification for my being here is that the Danforth Foundation does care about teaching: many of our grants and most of the Foundation's programs are related to college teaching. Most important--though I shall not be dealing with them except for some very generalized findings--we offer a series of fellowship programs designed for persons who declare their intention of becoming college or university teachers. There is considerable feedback from these DF Fellows, and currently much of it is critical of the education they are receiving.

A second justification, perhaps, is the fact that over the years from 1964 to 1967, the Foundation made 10 or 11 grants in support of teaching internship programs. The one at the University of Michigan described yesterday by Frank Koen was the most elaborate, the biggest, and the last in the series, but some progress reports on the others may interest you. (I should add parenthetically but immediately that the Foundation has declared a moratorium on grants for this purpose!)

A possible third justification lies in the Foundation's sponsorship of both regular and ad hoc conferences on teaching, for teachers. Last February, for example, we invited a group of younger college faculty--for the most part, under 30 and not on tenure--for a weekend of unstructured conversation on the future of the profession. There were 25 untenured and under-thirty faculty and, for self-protection, three or four people who were over thirty. Such conferences provide a listening post of importance for anyone trying to feel the pulse of the academic community; the February gathering was unusually provocative.

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In view of yesterday's different definitions of "intern," let me begin by describing how the Foundation interpreted "internship." For us, a teaching internship signified an institutional commitment to support a program in which something significant

would be added over and above an ordinary T.A. experience. The Foundation required that there be supervision by a senior member of the faculty. We wanted to guarantee a conscious effort on the part of the established faculty of the institution to prepare interns for teaching; we indicated that the Foundation was not ready to put dollars into programs which would perpetuate that which already was. As far as possible (Michigan was the exception), we supported programs which could carry themselves once Foundation money was no longer available. Finally, we expected that every intern would be given a range of teaching activities and would be exposed to more than one facet of the teaching profession.

The series of internship grants spread over a wide range of institutions and a good cross-section of departments. Dr. Koen described the Michigan grant where the distinguishing feature was the research component built into the program. A second one of the grants worth singling out is the one which Ann Heiss mentions in her research on graduate students. She pointed to Washington University where an unexpected by-product of the Danforth teaching internship program in History was the decision of the department to require a stint of undergraduate teaching for all of its graduate students, even those who were self-supporting. The History faculty specified that henceforth one of the fields to be offered in the oral examination would be a comprehensive area such as was developed in an introductory survey course. They found that this was one of the easiest, simplest, and most overlooked ways of reintroducing for advanced graduate students a broad perspective in the subject which most graduate courses had broken into specialized and narrow segments.

A third internship grant supported a program at the University of Chicago where the Foundation financed a New Collegiate Division plan for team teaching using pairs in which a senior member of the staff and an intern carried a section of an interdisciplinary course. Of all our grants, this is the program where the intern probably comes closest to playing the role of a real colleague. Mutual satisfaction of junior and senior staff is gratifyingly high; each profits from the presence of the other.

I will skip over the Danforth intern programs underway at Duke, Virginia, Emory, Vanderbilt, etc., save to say that the programs represent a variety of departments and have different backgrounds and focuses. Our hope is that out of the 10 or 11 grants, the Foundation will ultimately have some new ideas--perhaps new models--to feed into all kinds of internships and programs.

I would like to spend a couple of minutes on one internship program that may initially seem inappropriate for this group since your chief common denominator is that you represent graduate school programs. The Foundation established two internship programs in small liberal arts colleges, one at Earlham and the other at Antioch. Our idea was to test whether the initial teaching experience could more effectively be provided by the graduate school or the college. Both Antioch and Earlham have or have had interns in the sciences supported by NSF, so that by combining resources, there were seven to ten interns working in the sciences and in the humanities.

I think that all the teaching intern programs that I visited, the group that I came to be most jealous of was the group at Earlham. The program was under the leadership of the Philosophy Department which designed a series of courses interrelating Philosophy with other departments, the courses respectively labeled "The Philosophy of Science, History, etc." Each course explored the interface between philosophy and one of the disciplines; all were led by interdisciplinary teams, pairing the intern with senior faculty in the development of new courses.

The Earlham interns shared a low-keyed seminar in which interested members of the faculty joined with them for discussion of the problems of teaching and of the academy today. Needless to say, there was a lot of interaction among the interns at Earlham, for they were young, bright, interested. But they were impressed with the fact that the older generation at Earlham still talks about teaching, still talks about improving teaching and learning. Even tenured faculty enjoyed making TV tapes of their classes and analyzing successes/failures with younger colleagues. The tenured faculty at Earlham conveyed the impression that they were committed to self-renewal and that they were prepared to evaluate their own teaching. It was an eminently healthy situation and one which generated mutual respect.

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If I were to try to summarize what I have drawn so far from the experience of Danforth Fellows, Danforth internship programs, and Danforth conferences, I would begin with the flat statement that as of 1970 many of the very best graduate students, representing the very best institutions, declare that the graduate instruction they are receiving is shoddy. They think that it is dead, and that it is a toss-up as to whether it is today's graduates or undergraduates who get the worst deal in today's university. Since

graduate students leave the graduate school not much impressed with the training they receive or the people who gave it, it is not surprising that they are not in awe of the authority that hires them when they take on their first teaching assignment. It never occurred to members of my generation to question the authority that hired us or the standards for survival that they set for us, but such automatic respect is dead. Today's generation of young faculty and interns resent asymmetry in their relationship with senior members of the faculty in the same way in which today's brightest undergraduates often resent the authority in their classes.

A second finding is that junior faculty almost instinctively resent the imbalance of junior-senior colleagueship unless and until they are convinced that the older faculty with whom they associate are as open as they are to new ideas about teaching and research. At the weekend with the under-thirty group, we listened to a whole weekend of explosion against "publish or perish,"

The newly-minted Ph.D.'s insisted that any emphasis on publication distorts values and distracts from the need to focus on better teaching and reform in the curriculum. The older generation at the conference finally established the not-so-novel proposition that to respect a man's publication record does not necessarily mean to ignore his interest in teaching or his ability to build good relationships with students. Moreover, the senior faculty held fast to the notion that publishing and research are related to good teaching and they made some converts--almost as if the rationale had never been presented before. Ultimately we had consensus that while caring about people may be the essential point of departure for good teaching, it certainly does not provide the foundation for a lifelong career until and unless it has been buttressed by work in the disciplines.

Most of us in the Foundation are convinced that the problem of frustrated students in graduate school carry over after the graduate students become junior faculty. We believe that there is a real generational break often just under the surface in many departments and that it is one of enormous seriousness. There are outside standards and incentives to bring fresh concepts of research to isolated faculty, but this kind of outside reinforcement is not really available for teaching.

A rebellious attitude is increasingly characteristic of the graduate student-teacher, and graduate students are often separated from rather than linked with academe by the T.A. experience. It is also one of our conclusions that the routine teaching experience the T.A. receives can be one of the most frozen-in experiences of all the teaching in the undergraduate curriculum.

But I would say that of all the resentments that are building up with the graduate students, the interns, and the younger faculty it is that they firmly oppose a system in which the young are evaluated in their teaching while the old--cozily secure in tenured positions--are no longer subject to evaluation. Something has to give.

It is possible that American higher education is approaching a watershed in the preparation of university teachers. Dissatisfaction with the old concept of Let-them-learn-the-way-I-did is matched by scorn for the result. It would be unrealistic not to include hard economic facts in any projection of new models, for what happens to the job market for college teaching in the next five years is going to have an enormous impact on what kinds of T.A. programs and internships will be developed.

We may very well find the jobs at the bottom of the ladder once again using a label such as "Intern Instructors." And the label may serve as a justification for a pitiful salary. On the other hand, the situation may take a totally different twist. We may find national union of T.A.'s or instructors developing after the University of Wisconsin model. (I must say that I am very much of the old school and very unhappy at the thought of most of the implications of unionization of faculty.) Or we may find that the present "bottom" level of jobs is simply eliminated. Or we may use a lot more undergraduates in teaching than we have been doing up to now and for new reasons.

Whatever the economic situation, I do believe that in today's world the established group of faculty--tenured professors who are working with the graduate students and socializing new faculty--just have to convince the young who are working with them that it is still possible to change within the system, and that it is still possible to do exciting things with the curriculum. If we do not convince the young that this kind of colleagueship in adventure is possible, the university world of 1990 is going to be a very different world and, to me, not a very attractive one.

Dr. Lawrence W. Friedrich
U.S. Office of Education

In its NDEA Title IV fellowship program, the Division of University Programs of the U.S. Office of Education is putting increasing emphasis upon training those working for the Ph.D. to become good teachers of both undergraduate and graduate students. It is also encouraging institutions to put special emphasis upon training good environmental specialists, and upon providing help for the disadvantaged student.

The Office of Education is aware of the criticism leveled by students against the senior faculty in universities, especially renowned faculty, because they take too little interest in their students and are too little concerned about good classroom teaching. The Office of Education hopes it can do something about changing this even though there is not a great deal it can do about university faculty. There are educators who speak about abandoning everything we have been doing in graduate education and starting over again. They are doing this on an assumption, which can hardly be justified, that there is a necessary conflict between doing research and good teaching.

The Bureau of Higher Education and the Bureau of Educational Personnel Development in the U.S. Office of Education are the two Bureaus most prominently involved in supporting students who are going to become college teachers. The Division of University Programs in the Bureau of Higher Education administers two fellowship programs. One is the National Defense Education Act Title IV Fellowship Program. The peak year of this program, in terms of number of pre-doctoral students supported, was the 1968 fiscal year when 15,328 fellows were supported. Since then support has diminished. The other fellowship program is supported under Part E of the Education Professions Development Act. In the current year approximately 400 fellows are supported in this program, hardly any of whom are working for the doctorate. They are preparing to become teachers, administrators, and education specialists mostly in junior colleges. About 30% of the future teachers supported in this Program will be teaching disadvantaged students. Next year the budget for this program will be approximately doubled so the Office of Education will be supporting about 900 fellows in 1970-71.

The NDEA Title IV fellowship program was set up to train students working for the Ph.D., or its equivalent, who intend

to become college teachers. During most of the history of the program the Office of Education assumed that universities would do whatever is necessary to prepare its Ph.D. students for college teaching. However, in most institutions nothing special has been done. Almost all of the emphasis has been put on training in subject matter competence and in research. Two years ago I had a conference with a mixed group of fellows at a major university. There were about 45 in all, approximately two-thirds of whom were NDEA Title IV fellows. The others were in what we called the Title V-C Prospective Teacher Fellowship Program. The latter group were preparing to become secondary school teachers. One of the first students to answer when I asked whether they thought they should have formal training in teaching was a NDEA biology Ph.D. major who said he did not think any formal training in teaching was necessary. "All you need to do", he said, "is know your subject matter well and imitate your better professors." The Title V-C group challenged this. I then found myself moderating a debate for about thirty minutes. The students concluded their discussion by recommending that the Office of Education make special funds available to universities so they can release time for several of their best teachers and have them conduct programs for training graduate students in whatever is necessary to become good college teachers. The students came to the unanimous conclusion that watching a professor teaching is not enough to become a good teacher. Something more is needed.

The widespread criticism of the quality of college teaching has influenced the NDEA Title IV fellowship program. The Office of Education now tells institutions in its guidelines for proposal preparation to present a plan which provides quality teaching experience for fellows. Institutions are asked to respond to questions such as these: Are credit courses or seminars in college teaching required of all NDEA fellows? What is the extent and nature of the teaching experience planned for the fellows? To what extent is the fellow's teaching supervised and evaluated by the faculty?

The Office of Education is now taking the stand that, though a university department may have a fine research faculty, if it does not provide a satisfactory program of training in college teaching for its Ph.D. students, it should not be awarded NDEA Title IV fellowships since the university is not meeting the major objective of the Title IV program - that of training teachers for colleges and universities.

Under Part E of the Education Professions Development Act support is available for training people for college work. This includes the training not only of teachers but also administrators and education specialists. A student planning to go into college work who is not eligible for NDEA Title IV fellowship support can be eligible for this kind of fellowship. The Office of Education stresses strongly that institutions training these students must have some kind of internship in teaching in the type of institution in which the students will eventually be working. A good many of the institutions participating in this Program have internships in junior colleges quite frequently jointly supervised by the junior college faculty and the faculty of the institution. This is the first year in which the Office of Education is supporting EPDA, Part E fellows. The Education Professions Development Act was passed in 1967.

Since President Nixon's March 19, 1970 message on education and the subsequent introduction of Bill HR 16621 by Congressman Quie of Minnesota, it is not certain what direction graduate fellowship support will take in the future. After a meeting of a group of university presidents with President Nixon, Mr. Moynahan, at President Nixon's request, assured them that fellowship support for graduate students will continue at least at its present level until after a decision is made on the proposed National Foundation of Higher Education.

If HR 16621 is passed it will provide funds to encourage excellence, innovation and reform in higher education; to strengthen post-secondary educational institutions on courses of instruction that play a uniquely valuable role in American Higher Education or that are faced with special difficulties; and to provide an organization concerned with the development of national policy in higher education. That organization would be called The National Foundation of Higher Education. Organizationally, it would be modeled on the National Science Foundation. HR 16621, if passed, would repeal Title IV of the National Defense Education Act as of July 1, 1971.

If Title IV is repealed, then what will happen? HR 16621 provides for college teacher fellowships but gives no particulars. We in the Office of Education are now holding in-house seminars to discuss what would be the best form of fellowship support for graduate students in the future. To guide our discussions we have set up the following norms: (1) the fellowship program must be of benefit to the nation, (2) it must be of benefit to higher education institutions and to their students, and (3) it must be easy to administer both at universities and in the Office of Education.

In conferences with faculty and students at universities, Office of Education staff find that a student loan program, by itself, would not appear to be satisfactory support for graduate students. A loan program is not likely to be effective in inducing students to do doctoral work in order to become college teachers. Students comment that remuneration for teaching is too low to warrant going deeply into debt to prepare for it. A forgivable loan program might be acceptable but then such a program is really little different from fellowship support.

One of the new types of support under consideration is that of making a number of man-years of fellowship support available to an institution and then asking it to report on how it has used the man-years awarded to it. Another type of support might be that of awarding matching grants for teaching assistantships. Assuming 50-50 matching grants, the Office of Education could affect the support of twice as many graduate students with a given amount of money than it could by awarding full support fellowships. This would be important if the Federal Government found it necessary to induce as many students as possible to choose special fields of study which are of immediate importance to the nation's well-being.

The Office of Education is also looking into special support for the disadvantaged graduate students. A possible type of support is that of giving an institution which provides a program set up specifically for disadvantaged students a larger educational allowance for each fellowship than is given for other federal fellowships. A possible difficulty with this manner of providing support is that it would be rather hard to draw a sharp line between who is disadvantaged and who is not disadvantaged.

Another type of support program under consideration is that of providing an institutional assistance grant in addition to fellowships but not directly associated with them.

Working Group A: Making a Teaching Experience a Learning Experience

Chairman: Dr. G. Fred Somers, University of Delaware

1. The characteristics of the university, in some measures set the parameters of what is possible as a learning experience. For example, assistants can be heavily involved in the content and method of presentation of courses in the case where the student enrollment is relatively small. On the other hand, the opportunity for teaching assistant input to content and process are much more restricted in the situation which is typical of most universities.

2. In either case, however, opportunity to involve the teaching assistant in the learning process can be facilitated (a) if open-ended laboratory experiences are possible, (b) if one is not tied tightly to a particular pattern of laboratory exercises each semester, i.e. if the teaching assistants have an opportunity to suggest and develop some alternative exercises and (c) if the stage is set for such input.

3. Keeping a log of success of particular lab exercises is useful. It can provide a background of experience useful in planning new exercises.

4. While our emphasis has been upon the teaching assistant, we must not forget the need to provide quality instruction for the students he is teaching.

5. The use of upper-division undergraduates especially in the beginning courses can supplement teaching assistants and help provide staff depth necessary to provide the time required for teaching assistants to become involved in educational input into a course. Such input will help the teaching assistants to see themselves as colleagues rather than as slave labor--an important psychological factor in motivation. They want to help plan the course. It was suggested that undergraduate years might be the best time to start the training of perspective teachers by involving them in such a process.

6. Running a laboratory is a difficult operation. Teaching assistants should be involved in some preparation of materials of laboratory exercises so that they can become acquainted with the sources of materials, the methods, logistics, etc. of

laboratory management. But we must take care that this is not an excessive requirement demanding too much of the graduate students' time.

7. The professor in charge of the course must by his actions convey to the assistant his concern for quality instruction, but guidance of a given assistant is better provided by a more experienced teaching assistant or teaching fellow rather than by faculty.

8. Opportunity must be provided for teaching assistants to interact with more experienced teachers. Evaluation of success of various exercises is important. It was suggested that when a new exercise is proposed, the anticipated outcome be recorded at that time for comparison with the actual experience after the exercise has been undertaken...This becomes in some measure a test of a goal.

9. While we should strive for quality teaching, whatever that is, we should recognize that the actual manner in which this is accomplished is an individual matter.

10. Teaching assistants should consult with the students. They should become aware of their problems--a tutorial-like relationship was suggested.

11. The teaching assistant in a large course, with the professor doing all of the lecturing does not learn much about this aspect of teaching. Opportunities should be provided for experienced assistants to lecture, possibly using minilectures as preparation. This, of course, poses the problem if graduate students spend only one year as teaching assistants. Often there is some reluctance on the part of the teachers of large courses to allow the average teaching assistant to lecture.

12. One suggestion was made that professional funds be sought to support teaching assistants during summer months to develop laboratory exercises for the coming year.

13. It was suggested that some attention should be given to helping the teaching assistants overcome communication problems--bad speech habits, etc.

14. Student evaluations of laboratory instruction should be made available to teaching assistants.

Working Group B: A Model Intern Program

Chairman: Mrs. Karlene Schwartz, Boston University

We were charged with developing a working plan for a program that would give graduate students experience in the type of institution in which they hope to teach.

We chose to refer to this as a combination internship and externship program instead of using the term intern as it was used in our assignment. Let me just briefly define this. We assume that you would not send out students to flounder if they had not already had the opportunity to flounder in their own institutions; this would be a disservice all around. So, we decided to call internship working in the parent institution, externship working in the outside institution.

The advantages of an extern program were weighed against the disadvantage to the graduate student of leaving his own research program for an indefinite period of time. We talked about the increase in independence that could be gained at a small college and the increase in responsibility. It is obvious that there would be no graduate T.A.'s to help with the course, no undergraduate assistants, no course secretaries; there might be no course reading room, and there might be no preparator.

We also discussed the increase in responsibility of the student with regard to the more mechanical aspects of teaching such as the problem of getting teaching aids ranging from the computer to the audio-visual resources, having to scout for film library resources, and general library problems. A definite advantage seems to be the increase in interdisciplinary contact that can take place at a smaller institution and this might benefit both the student and the cooperating institute.

The student would probably be more involved in general biology courses than in his own specialized area. This could be an advantage in that it might grant a very efficient form of review to the student before his own examination. The student teacher experience, we thought, would probably differ greatly between the parent institution and the cooperating institution. First, the students in a smaller college might have quite different preparation for the course, and secondly they would probably be destined for different careers.

We talked at some length about the transition between the internship and the externship, a critical point. The internship definitely should precede the externship though there might be alternatives for experienced adult teachers or supervisors.

We also talked about the possibility of externship in their own institution for teachers who are unable to come to the parent institution at all. In other words, roving supervisors could go out. We hoped that there would be feedback from the externship schools that would improve the internship preparation. An example that is under way is the cooperation between the University of New Hampshire, which services teams in the area of marine ecology. Someone also mentioned the fact that Brown and Tougaloo have a team exchange of faculty and student.

We considered the fact that there may be opposition from both faculty and graduate students to internship and externship programs. First there is a problem of logistics regarding both teaching materials and the families of either faculty or students involved.

We talked about the participation with the staff in the major phases of teaching such as lecturing, organizing and directing laboratory work and the preparation of final grades, which I think is not a trivial point. This needs supervisory faculty and it needs discussion among the graduate students themselves. We have noticed at Boston University that it has been very profitable for graduate students to go to the faculty lecture in the introductory biology course and to go into each other's laboratories. They suddenly see the row of students in the back reading the newspaper; they see how many students leave the lecture after ten minutes or leave the laboratory to go to the bathroom and never reappear.

We touched on the problem of foundation support and agreed that this was probably necessary in many cases.

A highly competent discipline-oriented student who wishes to develop teaching curriculum reform or innovation as a central component of his graduate study could be served by internship-externship programs. Unlike laboratory research-oriented students, these interns would actively participate in a teaching internship that involves research in development, use, and evaluation of original curricula at the college level.

Working Group C: Guidelines for a Degree in College Biology Teaching

Chairman: Dr. Bruce M. Eberhart, University of North Carolina

Our meeting followed the panel discussion of the subject. We considered first the various degrees that could be offered. Rather than get involved in the conflict of the types of degrees that should be offered, we concentrated on the term "doctorate in biology teaching," so that we could talk to a general issue and avoid the individual solution of the problems that will be met on various campuses.

It is not necessary to review the standards in curricula for the Ph.D. in biology throughout the country because this is relatively standard. Rather, we focussed on the changes that seem appropriate at this time to underscore the new emphasis on teaching in biology. We considered that the doctorate in biology could have, first of all, a new direction toward the emphasis on inspired teaching. We proposed that this might be facilitated if there were two pathways available to the doctorate: the standard pathway currently available and a second path that should be characterized by equal excellence.

The second should parallel the first path in terms of curriculum through the point of the qualifying exams. After that, the candidate who has demonstrated his excellence should be able to choose a pathway that would emphasize research relative to the advancement of teaching or the application of teaching in biology. An example was given of the SESAME program at the University of California with a Ph.D. in Science or Mathematics. Research would be involved.

Any doctorate in biology should require teaching experience under qualified and concerned directors, a point made by the other committee. The six points, specifically brought up by Dr. Koen were emphasized as an example of the sort of guidelines that could be applied. The presence of a practicum in the form of either an externship or an internship was strongly advised and once again we overlap with the suggestions from the other committee.

In the doctorate program, interactions with the departments outside the biology department were strongly recommended, e.g., interaction with the department of psychology. Historically,

people have chosen to interact with the schools of education, but since they themselves get their raw material from more basic sciences it was felt that we should go directly to the source. We very carefully avoided recommending such courses as measurement, methods, psychology of education and public speaking, but we felt that the content of these areas should be considered. This is perhaps an indication of a desirable direction as opposed to a formal stipulation. No formal path was charted to these goals because of the multiple routes that are possible in attaining these teaching advancements.

If a doctorate in biology that departs from the current standard is to be created it must be based on excellence first of all. Secondly, once out of this program, the teacher must be able to continue in scholarly and productive activity in the area of creative biology teaching. The administration of the universities or colleges must recognize that there are two valid pathways to excellence in teaching. One pathway is the standard pathway of the usual Ph.D. program; the second is the pathway of the development of teaching procedures and scholarly activity in that area.

Finally, grants and post-doctorals should be made available for this second type of doctorate in biology. They will allow him to compete and be creative in the same sense as the individual taking the more standard degree could. In any case, alteration of the current Ph.D. in biology must receive support from all of us and we must move into an increasing emphasis on teaching excellence.